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THE

SCIENCE AND ART

OF

OBSTETRICS.

BY

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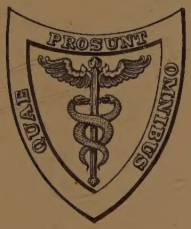

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TO

THE MEMORY

OF

DR. ALBERT H. SMITH,

THE SKILFUL OBSTETRICIAN AND GYNÆCOLOGIST,

THE ACCOMPLISHED PHYSICIAN,

THE HONEST MAN,

THE FAITHFUL AND GENEROUS FRIEND,

This Volume

IS REVERENTLY AND LOVINGLY INSCRIBED

BY

THE AUTHOR.

PREFACE.

THIS work was begun five years ago, and a task which then seemed comparatively easy grew in difficulty as the author proceeded in his effort to present a clear, and, as far as the limits of such a volume permit, a complete exposition of the Science and Art of Obstetrics. Nearly his entire time, for the last eight months, has been devoted to the rearrangement of material that had been collected, adding to it, and to its supervision as the book was passing through the press. He has endeavored to present the most recent information relating to Obstetrics, at the same time not overlooking important truths established by past experience. Having been actively engaged in practice for upwards of thirty-four years—and nearly two-thirds of that time a medical teacher—he has endeavored to write a book which will be useful alike to students and to practitioners.

The work contains several illustrations which have never appeared in any American treatise on Obstetrics; a few are original, and for the drawings of these he is indebted to his student, Mr. HENRY H. SHERK. Some of the illustrations have been so long used in obstetric works that it is impossible to state to whom they should be attributed. The greater number of the others are from Sappey, Luschka, Ramsbotham, Tarnier and Chantreuil, Depaul, Ribemont, Budin, Barnes, Schroeder, Spiegelberg, Bandl, Dalton, Bailly, Turner, and Balfour.

His thanks are due to Dr. HENRY MORRIS for the chapter on Anomalies of the Pelvis; to Dr. WM. H. PARISH for the description

of the Porro Operation; and to Dr. Wm. E. Ashton for the preparation of the Index.

With the hope that this treatise on the Science and Art of Obstetrics may prove acceptable and useful, he commits it to the profession.

1718 Walnut St., Philadelphia,
November 1, 1886.

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ERRATA.

Page 31, 8th line from bottom, *for* "18.4," *read* "13.4."
" 44, 20th line from bottom, *for* "arm," *read* "anus."
" 79, 14th line from top, *for* "meets serous tissue," *read* "mucous meets serous tissue."
" 88, line under cut, *for* "stricture," *read* "structure."
" 127, 4th line from bottom, *for* "found," *read* "formed."
" 143, 11th line from bottom, *for* "backward or forward," *read* "forward or backward."
" 235, 4th line from bottom, *for* "better safer to postpone," *read* "better to postpone."
" 369, *substitute for description of Fig.* 124, "Rotation and Delivery in Presentation of Face."
" 401, line under cut, *for* "distorted," *read* "dilated."
" 551, 11th line from top, *for* "32," *read* "42."
" 567, 10th line from top, *for* "sepsis," *read* "sepsin."

THE SCIENCE AND THE ART

OF

OBSTETRICS.

INTRODUCTION.

OBSTETRICS, the name given to one of the three fundamental divisions of medicine, is derived from the two words *ob* and *stare*, "to stand before," and strictly defined means the care of women during childbirth, but general use has extended the meaning of the term, so that it includes also the care of women in pregnancy, and in the puerperal state, or puerperality.

The words midwifery, tocology, parturition, and accouchement have been, and still are more or less used as synonymes for obstetrics. The first term etymologically means, and for some centuries practically meant, attendance by women upon women in labor. The name midwife,[1] variously spelled, is first met with in the fourteenth century, while the coarse, contradictory compounds, man-midwife and man-midwifery, do not appear until some two or three hundred years later. *Accoucher*—from *ac* and *coucher*, a derivation that brings to mind the expression "put to bed," once not unfrequently used for attendance upon a case of labor—is the origin of the noun accouchement; but although the last term has been adopted from the French into the

[1] I am indebted to Professor March, of Lafayette College, Easton, Penn., for the following note:—

Midwif does not appear in the Anglo-Saxon so far as yet explored; but in the earliest Old English vocabulary, the Promptorium Parvulorum, is *mydwife*, obstetrix (A. D. 1440). It is found earlier, in Peirce Plowman, A. D. 1394; Myrc's Duties of a Parish Priest, A. D. 1400, spelt *mydwyf* and *midwif*. In Wycliffe's Bible, A. D. 1380, it is *medewife*, and in the later version of that Bible *mydwiif;* William De Shoreham's Poems, A. D. 1330, *medewif*. This is the earliest appearance I know of.

I suppose it to be from *mid* and *wif*. The prefix *mid* is common. *Mid-coyshta*, a co-worker, is found in Anglo-Saxon; in Dutch, *mede-broeder*, a companion; German, *mit-bruder;* D. *mede-gemoct*, G. *mit-helfer*, etc. The idea is that of the Spanish *co-madre*, co-mother, a midwife, and like the German *bei-frau*. It may be conjectured that as a doctor's word it was liable to fanciful learned spelling, and that the Latin *medius* led to its being spelt *medewif* occasionally, or that the Dutch form influenced it. At any rate, this bad spelling led to the theory that it was *mede-wife*, which has been favored by Trench and others. The theory working in the minds of the early writers may also have led to the spelling. It is, however, a comparatively rare spelling, and the derivation suggested by it improbable.

English language, it has not by general use acquired full right of domicile. Tocology is a word rarely used by the profession; and parturition, from the Latin *partus*, has been by some authors restricted to the phenomena of labor occurring in inferior animals. It has seemed to me that *maieutics* is a better term, were it generally adopted, than any of those mentioned. It is more euphonious than obstetrics, and is equally classic in origin—μαιευο, and μαιευτής a male obstetrician, and μαιευτήρ, a female obstetrician—and does not prejudice the sex of the attendant, as the word midwifery does. But the substitution of obstetrics by maieutics would be regarded as too great an innovation, and hence the former will be used in this treatise.

Obstetric science means the classified knowledge of the laws of human reproduction; obstetric art includes the rules drawn from those laws, or from intelligent experience, which are to be observed in individual cases of women in pregnancy, in labor, or in childbed. While obstetric art may claim an antiquity as great as either of the other departments of medicine, obstetric science is of recent origin.

The tardy development of obstetric science is to be chiefly attributed to the fact that childbirth being regarded, justly, as a physiological function, and pathological conditions comparatively seldom occurring in its course, the practice of the obstetric art was almost exclusively in the hands of ignorant matrons; educated physicians were, if consulted at all, only called in case of serious difficulty. In the time of Hippocrates, dividing the umbilical cord seems to have been considered the chief duty of the midwife; she was called the omphalotomist. There could be but little progress with so narrow a conception of the office, and with the scant qualifications of those assuming it. It is true that at one time in the history of Athens, if the story concerning Agnodice be accepted, men only were permitted to practise obstetrics, but this custom was altogether exceptional, and even in the most enlightened nations the rule, until comparatively recent years, was that women in labor were under the care of one of their own sex. So universal was the custom of employing midwives, and so strong the prejudice against men engaging in obstetric practice, that in 1522 Dr. Wertt, of Hamburg, having put on the dress of a woman, and thus disguised attended a case of labor, was burned alive for the offence; and, a little more than a century later, Dr. Percivall Willughby, an eminent English physician, assisted his daughter, who was a midwife, in a case of difficult labor, crawling into the darkened room of the parturient on his hands and knees without her knowledge.

Chereau remarks that obstetrics was at first empirical, then superstitious, then scholastic, that is to say the almost absolute slave of theories and discussions, and that it did not attain finally a scientific character until the sixteenth and seventeenth centuries.

The obstetrician has a graver responsibility than has either the medical or surgical practitioner, for he has charge of two lives instead of one; while his efforts are directed to saving both, yet in some instances it may be that the one must be sacrificed for the salvation of the other, or saved at great risk to the other: hence may arise the most serious questions in casuistry.

The importance of obstetric knowledge is further shown by the fact that very frequently the emergencies which occur in the practice of the art are sudden, and must be met promptly if met successfully. They may give no time for consulting books, or a fellow practitioner, but immediate as is the peril must be the means to avert it.

Further, should a fatal result occur, the public is apt to visit unjust reproach upon the obstetrician; it is slow to understand how that which is usually a physiological process may end in death, or in only partial recovery. The obstetrician thus not only rests under greater responsibility than the physician or the surgeon, but is also liable to severer censure in case of failure or misfortune.

In this work it is proposed to consider first, the female pelvis, and the anatomy and physiology of the female sexual organs; second, pregnancy, its physiology and conduct, its pathology and treatment; third, labor and its conduct, and then its pathology and treatment. The fourth division will include childbed, or puerperality, with reference both to its physiology and management, and its pathology and treatment. While obstetric operations naturally belong chiefly, though not exclusively, to the treatment of the pathological conditions of labor, yet for convenience and for the clearer presentation of these operations, it is thought best that they should be considered in a separate division, which will, therefore, be the fifth, and the last.

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PART I.

THE ANATOMY AND PHYSIOLOGY OF THE FEMALE SEXUAL ORGANS.

CHAPTER I.

ANATOMY OF THE PELVIS.

THE pelvis is that part of the skeleton which is placed at the inferior portion of the body, and which, receiving the weight of the head and trunk, transmits it to the lower limbs. It has its name from a supposed resemblance in form to a basin once used by barbers, or from the fact that it serves as a temporary receptacle for certain secretions. Within or upon the pelvis the organs of reproduction are placed; through its canal the fœtus and its appendages pass; and the most serious difficulties in labor arise from its deformities. The study of the pelvis, therefore, is the first part of obstetrics; this knowledge is the very alphabet of obstetric science, and is the foundation of obstetric art.

The anatomical pelvis is formed by the union of four bones, viz., the two ossa innominata, the sacrum, and the coccyx; the obstetric pelvis includes also the last lumbar vertebra. But while the *static* pelvis is thus constituted, the *dynamic* pelvis—the pelvis in the living subject and in labor—has in addition certain structures which make its floor, and prolong the birth-canal; it is necessary for the obstetrician[1] to know two pelves, the one osseous, fixed, passive; the other soft, mobile, active. The former will be described first.

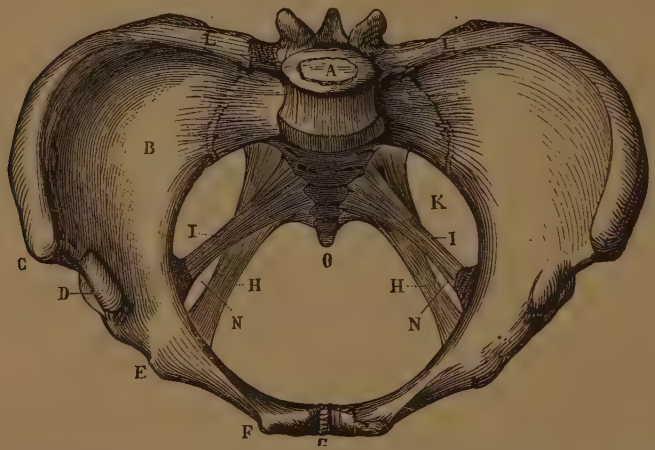
The innominate bones form the anterior and lateral walls of the pelvis. Each os innominatum or unnamed bone resembles an elongated quadrangle narrowed in the middle, and twisted at the point of narrowing so that the two halves are in different planes. In early life the bone is composed of three separate bones, and as between them the ossific union is not complete until the subject is eighteen or twenty years old, anatomists are accustomed to describe it according to these divisions. In Fig. 2 a faint white line indicates the separation of the bone into three parts; viz., the upper and larger portion (1) is called the *ilium*, the lower portion (2) the *ischium*, and the anterior (3) the *pubis*, or pubic bone.

The Ilium.—The external surface of this bone is called the dorsum.

[1] Boissand. De la forme de l'Excavation Pelvienne. Paris, 1884.

It is convex in front, concave behind, and is marked by three lines, superior, middle, and inferior curved lines; to the surfaces intervening

FIG. 1.



PELVIS WITH LIGAMENTS.—*A*. Last lumbar vertebra. *B*. Internal iliac fossa. *C*. Anterior-superior spinous process *D*. Anterior-inferior spinous process. *E*. Ilio-pectineal eminence. *F*. Spine of the pubis. *G*. Pubic symphysis. *H*. Great sacro-sciatic ligament. *I*. Less sacro-sciatic ligament. *K*. Great sciatic foramen. *L*. Ilio-lumbar ligament. *N*. Small sciatic foramen. *O*. Point of the coccyx.

between these lines the glutei muscles are attached. The anterior two-thirds of the inner surface of the ilium are smooth and concave, and are called the fossa or venter, and in the living subject are occupied by the iliacus internus muscle; the posterior third presents first a semi-lunar surface for articulation with the sacrum, and behind this a roughened part for the attachment of ligaments. The upper margin of the bone is S-shaped, and is called the crest; this crest is quite thick, and is described as having an external lip, an internal lip, and a roughened interval, these different parts furnishing attachment to important muscles. The iliac crest ends in front by a prominence known as the anterior superior spinous process, immediately below which there is a depression, and then another prominence called the anterior-inferior spinous process. Similar projections with an intervening depression mark the posterior margin of the bone, and they are known as the posterior-superior, and the posterior-inferior

FIG 2

LEFT INNOMINATE BONE.

spinous process; the word spine may very well replace spinous process in this connection. Immediately below the posterior-inferior spine the bone presents a deep notch, the sciatic notch. By means of two important ligaments hereafter to be described the sciatic notch is converted into two foramina, the great and the less. Through the former the gluteal, sciatic, and pudic bloodvessels, the sciatic and pudic nerves, and the pyriformis muscle pass out; and through the latter the pudic vessels and nerves re-enter the pelvis, and the tendon of the obturator internus muscle passes out. The ilium unites externally and below with the ischium and the pubis to form the acetabulum. Internally its union with the pubic bone is marked by an elevation important in obstetrics, the ilio-pectineal eminence; this eminence is in the anterior portion of a line, the ilio-pectineal or the innominate line, which marks the boundary between the true and false pelvis.

The Ischium.—This bone is irregular in form and is composed of a body, a spinous process, a tuberosity, and an ascending ramus. The body is the largest part of the bone, and from it the spinous process, broad in its origin, then tapering, projects; this process gives attachment to the less sacro-sciatic ligament and to the coccygeus muscle, while the great sacro-sciatic ligament is attached to the lowest part of the ischial tuberosity. The ramus of the ischium coming from the body of the bone is narrow, flat, ascends obliquely to meet and be fused with the descending ramus of the pubis, some irregular nodules marking their point of union.

The Pubis.—Each pubic bone is composed of a body and two rami or branches, the one known as the descending ramus, the other the horizontal, though the latter term is inappropriate, as the ramus has an oblique rather than a horizontal position. The body of the pubis is irregularly quadrilateral, and is obliquely directed from above below and from within out; by its internal margin it articulates with the body of the pubis of the other side, but beyond the pubic angle the superior margin of the body of the pubis presents an elevation known as the pubic spine.

The Sacrum.—This bone is single, symmetrical, and forms the greater part of the posterior wall of the pelvis. It is pyramidal in shape, narrowing from above down, from side to side, and from before back. It is directed from above below, and from behind forward obliquely, so that it forms by its articulation with the last lumbar vertebra an obtuse angle named the sacro-vertebral angle. The anterior face of the sacrum is concave, and presents upon the median line five smooth surfaces separated by prominent lines which indicate the place of union of the originally separate vertebræ of which it is formed; the first of these lines is most distinct, and in pelvic measurements upon the living may sometimes be mistaken for the sacro-vertebral angle. Four foramina are seen on each side of the median line; these are for the transmission of the anterior sacral nerves. On either side of the body of the first sacral vertebra may be seen the *ala*, or wing, the upper surface of which furnishes part of the dividing line between the false and true pelvis. The posterior surface of the sacrum is convex, and presents in the median line an irregular prominence known as the

sacral crest. Above, the crest is bounded by an opening called the orifice of the sacral canal. Below, the crest bifurcates, and the sacral

FIG. 3.

RIGHT INNOMINATE BONE. EXTERNAL SURFACE.

FIG. 4.

RIGHT INNOMINATE BONE. INTERNAL SURFACE.

1. Ala, or wing. 2. Acetabulum. 3. Crest of the ilium. 4. Anterior-superior spine. 5. Anterior-inferior spine. 6. Posterior-superior spine. 7. Posterior-inferior spine. 8. Sciatic notch. 10. Iliac fossa. 11. Rough surface for articulating with sacrum. 12. Innominate line. 13. Spinous process of ischium. 14. Ischial tuberosity. 15. Ischial ramus. 16. Horizontal ramus of pubis. 17. Articulating surface of pubic joint. 18. Descending ramus of pubis. 19. Spine of pubis. 20. Ischio-pubic foramen.

cornua are formed by the termination of each line. On each side of the sacral crest a depressed surface is observed, and in it are the openings, the posterior sacral foramina, for the transmission of the posterior sacral nerves. Two parts compose the lateral borders—an upper and a lower; the former is large and rough, the auricular surface for articulation

with the ilium, and behind this a more irregular surface for the attachment of ligaments; the latter is smooth, and gives attachment to the sciatic ligaments. The base of the sacrum, the superior surface of the first sacral vertebra, articulates with the last lumbar vertebra, and presents upon the median line a large, elliptic, concave, and horizontal facet. The summit or apex of the sacrum represented by the inferior surface of the fifth sacral vertebra presents a transverse elliptic surface for articulation with the base of the coccyx, while behind are the two sacral cornua already mentioned.

The Coccyx.—This bone, receiving its name from a fancied resemblance to the cuckoo's beak, is formed of five rudimentary vertebræ, and is triangular in shape, flattened from before back; it represents the caudal appendix in vertebrates. Its anterior surface is concave, its posterior convex; its borders give attachment to the sciatic ligaments; its base has an elliptic surface corresponding with that found on the apex of the sacrum with which it articulates, and two cornua which articulate with the sacral cornua; its apex, the fifth of the coccygeal vertebra, is often a mere tubercle, completely fused with the fourth vertebra. In case of bony union between the coccyx and sacrum an obstacle to natural labor may be presented.

FIG. 5.

SACRUM AND COCCYX.

Pelvic Joints.—Seven joints unite the bones forming the obstetric pelvis. They are three sacro-lumbar, two sacro-iliac, one sacro-coccygeal, and one pubic. Five of these joints are amphiarthrodial, or symphyses more or less analogous to those of the bodies of the vertebræ.

Sacro-Vertebral Joints.—The sacrum articulates with the last lower lumbar vertebra by the upper surface of the body of the first sacral vertebra, and by the two facets of the articular apophyses of this vertebra. Corresponding surfaces are presented by the under surface of the last lumbar vertebra; the union is similar to that existing between the other vertebræ. A remarkable peculiarity of the articulation is that the inter-vertebral disk of fibro-cartilage is twice as thick in front as it is behind, and thus the sacro-vertebral angle is formed.[1] The pelvic inclination does not depend entirely upon the angle, but in part upon the obliquity of the innominate bones to the sacrum. The union between the bodies of the vertebræ is amphiarthrodial, but that between the apophyses is arthrodial.

Sacro-Iliac Joints.—According to Sappey, these joints are intermediate between mobile and semi-mobile joints, though classed by most authorities as amphiarthrodial. Most anatomists state that the auricular surface of the innominate bone, and the corresponding surface of the sacrum are covered with cartilage, the covering being much

[1] Morris, op. cit.

thicker upon the latter than upon the former; that which is upon the innominate is fibro-cartilage; that of the sacrum consists, first, of cartilage adhering to the bone, and, second, of fibro-cartilage. The existence of a synovial membrane, especially distinct in case of pregnancy, is taught by some authors.[1] Morris, however, holds that the cartilaginous mass uniting these bones is single, and not composed of two plates with a synovial space between them, stating that such may be the case sometimes, but that it is not constant, certainly not in the male, though more frequent in the female; if two plates are present, the joint is arthrodial. The joint is further secured by the following six ligaments: the ilio-lumbar, extending from the transverse process of the last lumbar vertebra to the crest of the ilium, is a firm band of fibrous tissue which not only greatly strengthens the joint, but helps to form the posterior wall of the false pelvis; the antero-superior, the antero-inferior, the postero-superior, the postero-inferior, and the inter-osseous ligament complete the direct means by which this joint is made one of the strongest in the body. But additional strength is given to it by the sacro-sciatic ligaments. The great sacro-sciatic ligament arising from the posterior part of the superior curved line of the dorsum of the ilium, from the postero-inferior ilio-sacral ligament, from the side of the sacrum and of the coccyx, is attached to the lower portion of the ischium and to its ramus; this ligament is broad at first and then in its middle is narrowed, but again widens as it approaches its points of attachment. The less sacro-sciatic ligament is in front of the former, and is triangular in shape; it arises from the sides of the sacrum and the coccyx, and is at first confounded with the great ligament; afterwards it becomes distinct from the former in making the lower boundary of the great sciatic foramen, and passes to its attachment to the spinous process of the ischium.

When in labor the head has descended into the pelvic cavity, the expulsive force drives it against the lower portion of the sacrum, and hence results a strain upon the sacro-iliac joints tending to throw the lower part of the sacrum backward; but nature guards against such dislocation by these strong fibrous bands which unite the sacrum and the ischium.

The Sacro-Coccygeal Joint.—This is composed of two articular surfaces, an interosseous fibro-cartilage, and four peripheral ligaments. The retrocession of the coccyx thus secured adds materially to the antero-posterior diameter of the outlet. Sappey states that, prior to their consolidation, all the inter-coccygeal articulations are symphyses, and Lenoir that the backward movement referred to takes place between the first two bones of the coccyx, as between the first and the sacrum; exceptionally this motion is found to be between the second and the third, or between the third and fourth. Verneau[2] says that he has frequently found even in young subjects complete synostosis of the sacrum and the coccyx, and describes the two as a single bone.

The Pubic Joint.—Fibro-cartilage similar to that of the inter-vertebral disks is firmly fastened to the articulating surface of each pubic bone. This fibro-cartilage is soft in the middle, firm externally; it is much thicker in front than it is behind—thicker, too, in females than it is in

[1] Anatomy of the Joints. [2] Le Bassin dans les Sexes et dans les Races.

males; the presence of a synovial membrane is asserted by some, Allen, for example,[1] stating that in the adult male its size is not greater than that of a split pea, but that it is larger in the adult female, and in the parturient may involve the entire thickness of the joint. Morris, however, only describes a fissure running through more or less of the antero-posterior as well as the vertical depth of the cartilage; it partially divides the cartilage into two plates, with a minute viscid pulp or a little fluid in the interspace; it is found in males as well as in females, but not constantly in either sex. Depaul and other French authorities generally deny the presence of a synovial membrane in the pubic joint; this, too, is the teaching of most anatomists. Four ligaments add to the strength of the joint. These are the posterior, which is chiefly thickened periosteum; the anterior, thicker and stronger than the preceding, is formed by several layers of fibres crossing each other obliquely, some of them continued into the inferior ligament; the superior consists of layers of yellowish fibres attached to the pubic crest on either side, and at the middle closely united with the interosseous cartilage; and, finally, the inferior or subpubic ligament. The last, also called ligamentum arcuatum, three-eighths of an inch in its vertical measurement, is composed of closely joined fibres, and fills up the angle made by the pubic rami, forming an arch, the pubic arch, a part of as great obstetric importance in the outlet, as the sacro-vertebral angle is in the inlet of the pelvis.

Movements of the Pelvic Joints.—Of course there are in the three sacro-vertebral articulations movements similar to those of the vertebral joints elsewhere. There is also, as has been before mentioned, an important movement in the sacro-coccygeal joint, or in one or more intercoccygeal joints, allowing deflection or pushing back of the coccyx, thus increasing the antero-posterior diameter of the pelvic outlet. But are there movements in the other pelvic joints by which pelvic diameters are notably increased? Dr. J. Matthews Duncan holds that in labor important movements occur in the sacro-iliac joints, movements which he describes as an elevation and a depression of the pubic joint; or, if the sacrum be regarded as the moving bone, it has a nutatory motion upon an imaginary transverse line, passing through its second vertebra. Elevation of the pubic joint, or its equivalent forward movement of the superior part of the sacrum, lessens the antero-posterior diameter of the inlet, but increases the corresponding diameter of the outlet. On the other hand, Mattei and Laborie assert an increase in the transverse diameter of the outlet by the wedge-like pressure of the fœtal head. But the form of the articular surfaces of the sacrum and the innominate bones is such—elevations upon the one fitting into depressions on the other, and the reverse—that any movement between these bones, whether it be described as rotation of the innominates upon the sacrum, or a movement of the base of the sacrum forward, while the lower portion of the bone moves backward, seems improbable, or impossible, in ordinary conditions. Moreover, the fixed position of the sacrum is further secured by its shape, and by the ligaments belonging to the sacro-iliac joint, and also by the sacro-sciatic ligaments, and

[1] Human Anatomy.

by the ilio-lumbar ligaments. "The shape of the sacrum, and the mode in which it articulates with the ossa innominata, render its position a secure and ordinarily an immovable one."[1] In so far as this movement of the sacrum, supposed usually to occur in all cases of labor, increases the coccypubic diameter, nature has provided a simpler method, which has been pointed out, and hence this is unnecessary.

Uses of the Pelvic Joints.—Since, then, movements[2] may be considered as almost *nul* in the pelvic articulations, why is not this osseous girdle made of a single bone? The answer is that these joints have as their result the decomposition of forces, and thus prevent shocks and jars received by the lower limbs being transmitted directly to the vertebral column. Thus the uterus and the ovum as well as the prolongation of the spinal cord in the sacral canal are guarded from injury. These joints, especially the pubic,[3] are swelled during pregnancy, permitting a slight separation, but such swelling is not for the increase of pelvic diameters, but for providing against injuries from falls or jars; they serve a purpose similar to that of the cushioned buffers of railway cars.

The Pelvis as a Whole.—Its External Surface. This is of no great obstetric importance; still a few points are worthy of attention. One feature of the pelvis is most striking, the great difference as to completeness between its anterior and its posterior portion. Behind, the bony wall is complete from the beginning of the last lumbar vertebra to the tip of the coccyx; while in front the girdle presents a wide gap from the anterior margins of the iliac bones, above the pubic joint; the girdle is completed at the joint, but below another gap is formed, its boundaries being the divergent ischio-pubic rami. The ischio-pubic foramen[4] is observed on either side; this foramen is closed by a membrane, and covering the membrane a muscle, known as the obturator externus, in the living subject. The posterior surface, formed chiefly by the sacrum and coccyx, is triangular, the base of the triangle being superior. In the median line the sacral crest, formed by the fusion of the spinous processes of the sacral vertebræ, is found; on either side of the iliac tuberosity, and intervening between these and the sacral crest, is a gutter, the two portions being occupied in the fresh subject by the sacro-lumbar muscles, while at the external side of each the posterior sacral foramina open. In general the rough, irregular surface of the pelvis posteriorly is in striking contrast with the corresponding internal surface.

Internal Surface of the Pelvis.—Though the external surface of the

[1] Morris. [2] Depaul.

[3] Budin (*Progrès Médical*, 1875) examined more than eighty pregnant women to ascertain whether there were movements in the pubic joint. The method of examination was to introduce the index finger into the vagina, and apply the pulp of the finger directly against the inferior margin of the joint while the subject was standing, and then have her walk. At each step she took he found that the finger was pushed down by the descending pubic bone of one or of the other side; that bone descends which corresponded with the limb moved; the one corresponding with the limb that was fixed remained without change in position. His conclusions were, that in all pregnant women there was in the last months of pregnancy a certain mobility in the pubic joint; this mobility is greater as the pregnancy approaches its end; almost absent in primiparæ, it increases with the number of pregnancies. Even where there was very considerable mobility the subjects walked without difficulty.

[4] Verneau remarks, *op. cit.*, that "foramen ovale" is incorrect, and "obturator" meaningless.

pelvis is rough and irregular, and presents no lines for artificial division, the internal surface is smooth and symmetrical, and is plainly divisible into two parts, an upper and a lower, the dividing line being formed by the upper anterior margin of the sacrum and its alæ, and the innominate, or ilio-pectineal line. The upper portion is known as the false, superior, or large pelvis, while the lower is the true, inferior, or small pelvis, or simply the pelvic cavity. The posterior wall of the upper, or false pelvis is formed by the last lumbar vertebra and the ilio-lumbar ligaments; its lateral walls are the iliac bones; in front the wall is absent, but in the living subject the gap is closed by the lower portion of the elastic abdominal wall, which, readily yielding, furnishes space for the uterus enlarging in pregnancy.

The convergence of the bony walls of the false pelvis—a convergence which, if continued, would cause them to meet at a point corresponding with the fourth sacral vertebra—has suggested the comparison of this part to a funnel which serves to direct the fœtus into the pelvic cavity. The comparison is more striking when we remember that in the living subject the interval between the anterior margins of the iliac bones is closed by the lower part of the abdominal wall.

Measuring from the highest point of the iliac crests to the plane of the inlet, the distance is a little more than three inches and a half, or nine centimetres and a half. The distance between the anterior-superior spines is about ten inches, or twenty-six centimetres, and between the anterior-inferior spines a little more than nine inches, or twenty-four centimetres; the widest interval between the iliac crests is eleven inches, or twenty-eight centimetres. These measurements vary somewhat in different subjects, but any notable deviations from those given of the distances between the iliac crests, and between the spinous processes, would be indicative of pelvic deformity.

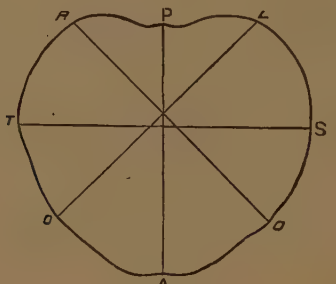
The Pelvic Inlet.—The entrance to the pelvic cavity is called the inlet, superior strait, brim, margin, or isthmus. The fitness of the term inlet is plain, while its being "narrower than the upper pelvis, less in extent than the lower," there is a fitness also in the names strait and isthmus. Pelvic deformities most frequently affect the inlet, and therefore its study has especial importance. Its form is irregular, and has been compared to an ellipse, to a circle, to a spherical triangle, to the heart of a playing card; it has been spoken of as oval, and as kidney-shaped. Its regularity of form is chiefly broken by the projection of the sacro-vertebral angle, commonly spoken of as the promontory, and thus a large, round notch is made which is similar to the notch in the playing-card heart.

The subjoined diagram represents the form of the inlet, and also the four diameters which are of obstetric importance. These diameters are an antero-posterior, a transverse, and two oblique. The oblique diameters connect what have been known as the four cardinal points of Capuron, viz., the right sacro-iliac symphysis with the left ilio-pectineal eminence, the left sacro-iliac symphysis with the right ilio-pectineal eminence. The first is known as the right,[1] the other

[1] Some confusion arising from the fact that obstetric authors differ in the application of the terms right and left to these diameters, one designating that as right which another calls

as the left oblique diameter, the sacro-iliac symphysis determining the name. Further, it will be observed that the transverse diameter, which represents the widest measurement of the inlet, passes in front of the intersection of the oblique diameters, and this is characteristic[1] of the normal female pelvis, indeed one of the means by which the female can

FIG. 6.



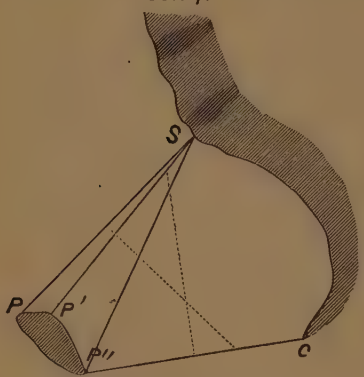
THE INLET, OR SUPERIOR STRAIT.

A P. Antero-posterior diameter.	4–3 to 4–5 inches, or	11–11½ centimetres
T S. Transverse	5–3 " or	13½ "
R O. Right oblique.	4–7 to 4–9 " or	12–12½ "
L O. Left oblique	" " "	" "

The circumference of the inlet is 15 8 inches, or 40 centimetres.

be distinguished from the male pelvis. The antero-posterior, sacro-pubic, or conjugate diameter extends from the sacro-vertebral angle to the pubic symphysis. The last is the shortest of the four, while the transverse is the longest; but the latter, as will be seen hereafter, is lessened by the encroachment of soft parts, so that each oblique diameter exceeds it, and hence the frequency of oblique positions of the fœtal head as it enters the inlet.

FIG. 7.



ANTERO-POSTERIOR DIAMETERS OF INLET.

S P. Sacro-supra-pubic diameter.
S P'. Sacro-sub-pubic "
S P''. Minimum "

In addition to the antero-posterior diameter of the inlet which has been given, and which may be distinguished as the sacro-supra-pubic, two other antero-posterior diameters are to be mentioned, called the sacro-sub-pubic, and the minimum useful or true conjugate; the three diameters are represented in the subjoined diagram from Pinard. It will be observed that all these diameters start from a common point at the sacro-vertebral angle, but extend respectively to the superior margin of the pubic joint, to its inferior margin, and to its nearest point.

left, and *vice versa*. While the selection is chiefly arbitrary, it seems more natural that the relation of right and left be made according to the sacro-iliac joint concerned.

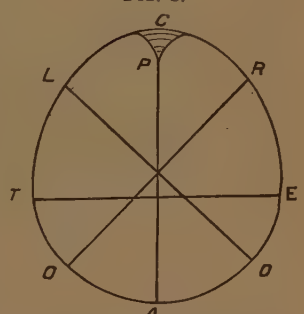
[1] This statement, made by Verneau, I have verified in the measurements of some twenty male and female pelves.

In case of pelvic deformity involving the inlet it is important to know what the minimum useful or true conjugate diameter is, and this is obtained by first ascertaining the sacro-sub-pubic diameter and deducting from this, if the pubic symphysis measures one inch and a half, four centimetres, or more, one-half to seven-tenths of an inch; but if the pubic symphysis is less than an inch and a half, the reduction must be one-half to three-tenths of an inch.

The Pelvic Outlet.—While the boundaries of the inlet are formed of bone, and present a comparatively regular outline, those of the outlet are in part ligamentous, and are marked by projections of bone, the ischial tuberosities and the coccyx, and deep intervals, the most important of which is the pubic arch. Nevertheless, a somewhat rhomboidal form is attributed to the outlet. The sub-pubic ligament is its anterior boundary, its posterior the coccyx, while intervening on either side are the ischio-pubic ramus, the ischial tuberosity, and the lower surface of the sacro-sciatic ligaments. The pubic arch is somewhat triangular, the base extending from one to the other ischial tuberosity, and its apex rounded by the sub-pubic ligament.

As in the inlet, so in the outlet, four diameters are given, one antero-posterior, or coccy-pubic, one transverse, and two oblique. The first measures the distance from the tip of the coccyx to the sub-pubic ligament; the transverse that between the ischial tuberosities; while the oblique extend on either side from the middle of the under surface of the sciatic ligaments to the junction of the ischio-pubic rami. The oblique diameters may be slightly increased by yielding of the sciatic ligaments, but this is unimportant. On the other hand, an important increase in the antero-posterior results from recession of the coccyx, so that it becomes the longest diameter of the outlet, whereas it is the shortest of the inlet; the latter, since it is the shortest diameter of an ellipse, is correctly called the conjugate; but to apply, as some do, this term to the former, is plainly a mistake.

FIG. 8.



THE OUTLET AS SEEN FROM BELOW. —*C* Under surface of the coccyx. *A P.* The antero-posterior, or coccy-pubic diameter. *T E.* Transverse. *R O* and *L O.* Right and left oblique diameters.

Each of these diameters is about 4.3 inches, or eleven centimetres. The antero-posterior is increased by the recession of the coccyx, from one-half to one inch; the average increase is probably about three-fourths of an inch. The circumference of the outlet is 18.4 inches, or 34 centimetres.

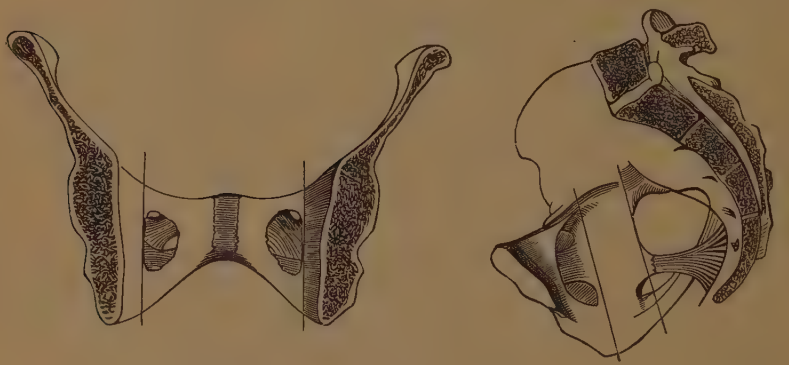
The Pelvic Cavity.—The pelvic cavity, the small or true pelvis, thus bounded by inlet and outlet, is somewhat cylindrical or barrel-shaped. Its walls measure one inch and a half in front, three inches and a half at the sides, and posteriorly four inches and a quarter, or, following the curve of the sacrum, about five inches and a half; the corresponding metric measurements are: 3.8, 8.9, 10.8, and 13.8 centimetres.

Mr. Morris[1] calls attention to an important fact in obstetrics, viz., that in no horizontal pelvic plane is the bony wall of the pelvis complete, for opposite the pubic symphysis is the movable coccyx, and thus at one point or at another of the cylinder there is always in some part of the plane either a joint motion or that permitted by elastic tissue. The protection from injurious pressure thus secured to the fœtus and the maternal soft parts is obvious.

The transverse measurements of the pelvic cavity lessen from above below, while the antero-posterior increase. The average diameters of the pelvic cavity are about four and three-quarter inches or twelve centimetres. The antero-posterior diameter is measured from the middle of the posterior surface of the pubic joint to the middle of the line uniting the second and third sacral vertebræ; the transverse intersects and is perpendicular to the former; the oblique diameters connect the middle of each great sciatic foramen with the middle of the ischio-pubic foramen of the opposite side. The points which the oblique diameters connect not being fixed, little importance is attached to the latter. It is plain that any oblong body, and the fœtal head is such a body, which is longer than four inches and three-fourths cannot, having entered the pelvic cavity, pass out of it unless that part which entered first goes out first. This is illustrated in labor both in presentation of the vertex and in presentation of the face.

Inclined Planes of the Pelvis.—The walls of the pelvic cavity, though presenting no natural lines of separation, have been arbitrarily divided so as to represent certain inclined planes which were held to have an important influence in determining a part of the mechanism of labor. These divisions have varied with different obstetric teachers. The late Dr. Hodge, for example, after the antero-posterior division of the

FIG. 9. FIG. 10.



ANTERIOR PELVIC WALL AND LATERAL PLANES.

pelvic cavity in the median line, had each half divided by a line beginning three-quarters of an inch in front of the sacro-iliac joint and extending downwards to the extremity of the spine of the ischium;

[1] Op. cit.

thus two anterior and two posterior inclined planes were formed, and an object impinging upon either of the former rotated into the pubic arch, while if impinging upon either of the latter it rotated into the hollow of the sacrum. Other authors make the line of division between anterior and posterior planes farther forward. Still others, after dividing the pelvic walls into anterior, posterior, and two lateral walls, divide each of the latter—a lateral wall includes the part of the pelvis between the sacro-coccygeal surface and a line drawn from the ilio-pectineal eminence downward through the ischial tuberosity—into two inclined planes, the anterior and the posterior. Figs. 9 and 10 show the anterior wall of the pelvic cavity and the lateral inclined planes.

It ought, however, to be said that few obstetric authorities in explaining the mechanism of labor attach to these arbitrarily formed planes the importance which was once given to them.

Obliquity, Horizontal Planes, and Axes of the Pelvis.—The pelvis is not in the axis of the body, a fact which is at once evident when it is observed that the sacro-vertebral angle is nearly four inches higher than the superior margin of the pubic joint, but it is placed obliquely with regard to that axis, and hence the expression *inclination* or *obliquity* of the pelvis. This obliquity is caused, first, by the form of the articulating face of the upper sacral vertebra, which is so oblique as to make an acute angle with the anterior surface of the body of the bone; second, by the shape of the cartilage between the sacrum and the lumbar vertebra with which it articulates; and finally by the obliquity of the innominate bones in their articulation with the sacrum. The result of this obliquity is that the weight of the gravid uterus is borne chiefly by the anterior abdominal wall and the superior border of the pubis. In order the better to show this obliquity of the pelvis, it may be stated that the angle made by the antero-posterior diameter of the inlet and a line representing the axis of the body is from 130° to 140°, and that this diameter prolonged in front makes with a horizontal line an angle of 60°.

While, as taught by Naegele, the obliquity of the pelvis was represented by the angle made by the antero-posterior diameter of the inlet with a horizontal line—the subject standing—an angle which varied from 55°–60°, it is now held that this angle may vary greatly within even the lower of these limits, as the following passage from Kleinwächter[1] explains:—

> Naegele understood by it that angle which the conjugata vera makes with the horizon. (Fig. 11.)
>
> Later researches showed, however, that, although this hypothesis is in general true, still the angle has no fixed size, but changes with various positions of the body. The most reliable angle (Fig. 12, *B*), indicating the pelvic obliquity, is, according to H. Mayer, that which a horizontal line makes with the so-called diagonal conjugate, the distance from the upper margin of the pubic joint to the middle of the anterior surface of the third sacral vertebra: this angle measures 30°. The pelvic inclina-

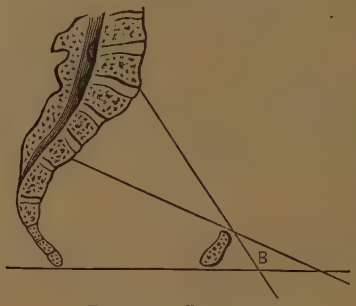
[1] Grundriss der Geburtshülfe.

tion, too much overrated in former times by Stein the elder and Naegele the elder, does not have any practical significance, for it may be changed by a corresponding change in the position of the parturient.

FIG. 11.

PELVIC OBLIQUITY.

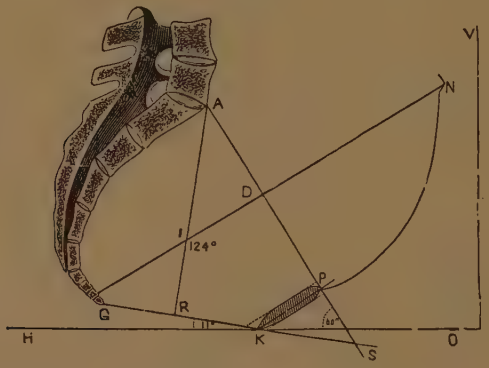
FIG. 12.



DIAGONAL CONJUGATE.

It will be seen (Fig. 13) that the coccy-pubic diameter prolonged in front makes an angle with the horizontal line of 11°, or 10° to 11°. But if the coccyx be pressed backward, as it is in labor, that diameter coincides with the horizontal line at first, and then forms an angle with, but below it.

FIG. 13.



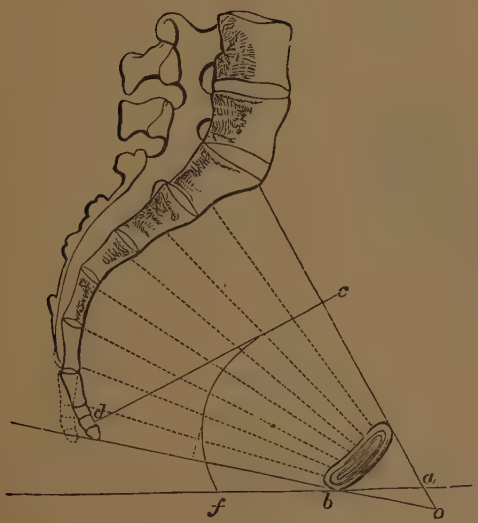
PLANES AND AXES OF THE INLET AND THE OUTLET.—*H O.* Horizontal line. *V O.* Vertical line. *N.* Umbilicus. *A R.* Axis of the outlet intersecting at *I*, the axis of the inlet. *A P.* Sacro-pubic diameter. *C K.* Coccy-pubic diameter.

The plane of the inlet is a surface supposed to touch all points of the circumference of the inlet; the antero-posterior diameter of the inlet is a line which measures that surface from before backward. The axis of the inlet is a perpendicular to the surface at its middle point, or, more simply, a perpendicular to the antero-posterior diameter at its middle.

Similarly the plane of the outlet is a surface which theoretically touches all points in its circumference; the axis of the outlet is a perpendicular erected at the middle of its antero-posterior diameter. As will be seen from Fig. 13 the axis of the inlet prolonged below meets the axis of the outlet, forming with it a very obtuse angle. In

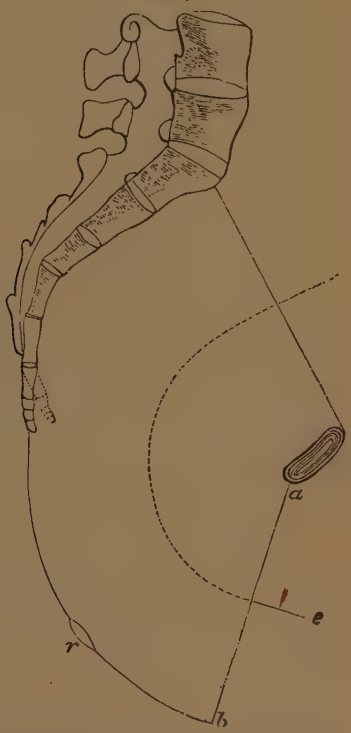
the illustration this angle measures 124°. Further, as shown in the diagram, the two antero-posterior diameters mentioned, if prolonged in front of the pubic joint, soon meet; but as these lines simply represent the middle of the surface of the inlet, and that of the outlet, it follows that the planes of the inlet and outlet would in like manner meet. If the axis of the inlet be continued beyond the point where it meets that of the outlet, it would strike the coccyx—according to some the sacro-coccygeal articulation; extended above, it passes out at or a little below the umbilicus. It is therefore obvious that the plane of the inlet is very oblique, while that of the outlet—the subject supposed to be standing—is nearly horizontal. Behind, the planes are separated by the length of the anterior surface of the sacrum and coccyx, while in front only the length of the pubic joint intervenes. It follows that the planes of the pelvic cavity cannot be parallel, but must converge as they move from the posterior wall, meeting in front of the pubic joint, and are included between the plane of the inlet and that

FIG. 14.



INCLINATION AND AXIS OF THE PELVIS.

FIG. 15.



AXIS OF THE CHILD-BIRTH CANAL.—*r*. Rectum. *a b*. Plane of outlet of completed canal. *e*. Perpendicular to plane, or axis of expulsion.

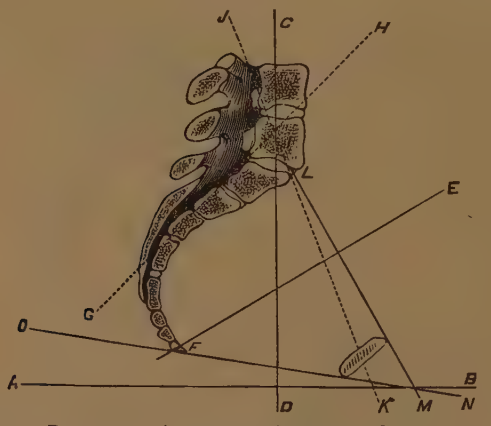
of the outlet. To ascertain the mathematical axis of the pelvic cavity, a series of planes may be imagined to extend from the intersection of

the inlet and outlet planes to the anterior surface of the sacrum and coccyx. Take in the pelvic cavity the central point of each of these planes, and then a line connecting these central points is drawn; this line, which is curved, its concavity anterior, represents the axis of the pelvis.

The pelvic axis is also known as the central line, and the line of direction. It may be further defined as a curved line passing through the centre of the pelvic cavity, equidistant from the sacrum and the pubic bone. While on theoretical grounds it is claimed that the fœtus in its passage through the pelvic cavity follows this curved line, and that in the use of the forceps traction should be made according to this line, yet it is to be borne in mind that this view applies to the static pelvis only, and it will be materially modified by the study of the dynamic pelvis. Fig. 15, from Leishman, illustrates the generally accepted statement as to the axis of the birth canal, that is, of the pelvis and its prolongation by the addition of soft parts yet to be described.

While the relation between the pelvic planes and the pelvic axes is necessarily unchangeable, always remaining the same whatever the position of the body, the relation of these planes and axes to the body and to the horizontal line is necessarily changed by that position. For example, let the subject be standing. The axis of the body makes

FIG. 16.



RELATIONS OF PELVIC PLANES AND AXES DUE TO CHANGES IN POSITION OF THE SUBJECT. *A B.* Horizontal line. *O N.* Antero-posterior diameter of outlet. *F F.* Axis of inlet. *C D.* Vertical line. *H G.* Change caused by leaning forward. *J K.* By bending backward.

with a horizontal line an angle of 90°. Now let the body incline forward, the angle is lessened, and the axis approaches the axis of the inlet; now let the movement of the body be reversed, and the axis of the body is thrown farther from that of the inlet. When the subject is standing, the plane of the outlet is nearly horizontal; but if she be lying on her back, the plane is almost vertical, and its axis is nearly a horizontal line; and from this fact the practical rule has been drawn, that in delivery of the head through the outlet by the forceps the pulling should be in a horizontal line.

Differences in the Pelvis as to the Individual, Sex, Age, and Race.—Individual Differences.—As no two faces are exactly the same, so it is probable that no two pelves can be found which do not present some differences. Moreover, no pelvis is perfect in symmetry, form, and normal measurements. It has been said that, as the perfect statue exhibits the separate perfections of many individuals combined in the artist's representation, so the perfect pelvis of the obstetrician represents a combination of the perfections derived from various pelves.

Without any positive deformity, and without such change in form as to present serious hindrance to labor, pelves differ in size. There may also be differences in the thickness of the pelvic bones, in their relative smoothness or roughness, in the height of the pubic arch, in the size of the angle, in the breadth, length, and curvature of the sacrum, in the depth of the iliac fossæ, and in the distance between the iliac spines or iliac crests. As a rule the development of the pelvis corresponds with that of the lower limbs. It does not follow that a tall woman has a small pelvis; its development may be in perfect relation to her stature; if her labor be protracted, while that of another, whose stature is much less, be brief, the occurrence is to be attributed, as Dubois has said, to the fact that in the latter the pelvic canal is shorter.

Levret asserted that the circumference of the inlet was one-fourth the height of the individual. Finding the latter it was very easy to determine the former. But results have not proved the correctness of the assertion.

Weber sought to establish an analogy between the head and the pelvis. As heads present various forms, but can be reduced to four chief ones—viz., oval, round, conical, and square—so the various forms of the pelvis may be reduced to the same types, and these types coincide in the individual—that is, the pelvis corresponds in form with the head. Not only so, but certain measurements of the head will represent pelvic measurements. Thus, the measure between the zygomatic arches represents that of the transverse diameter of the superior strait, while its antero-posterior diameter is found by taking the distance from the root of the nose to the chin.

As observed by Depaul, this theory, if it were correct, would be of great service to the obstetrician; but, unfortunately, experience has not sustained it.

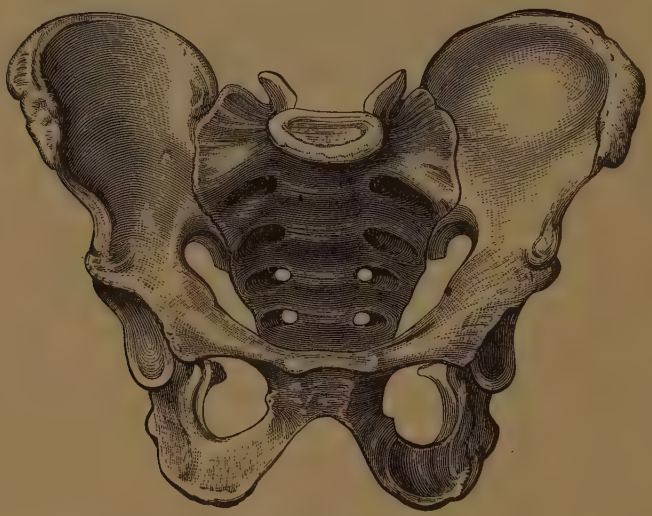
Differences in the Sexes.—Verneau[1] regards the sexual differences presented by the pelvis as much more positive than those of any other part of the skeleton, "although many of the differential characters commonly given are without value, such as the form of the ischio-pubic foramen, or are entirely false, such as the greater concavity of the sacrum in the female."

Of course the pelvic bones, like the other bones of the skeleton, are in the male rougher, thicker, stronger, and less delicately curved than in the female. But there are many special characteristics which have been fully studied by Verneau. The most important of these will now be presented. The differences belong chiefly to the pelvic cavity, and

[1] Op. cit.

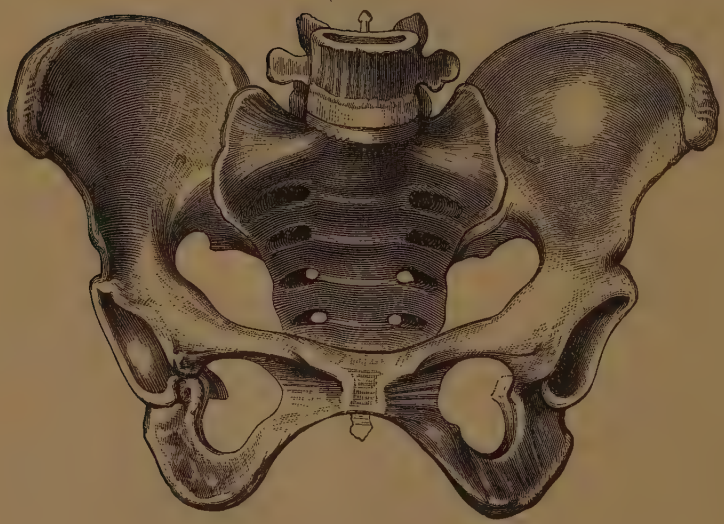
are determined by the presence of the uterus. All the dimensions of the internal iliac fossa are less in the female, except the distance from the antero-superior iliac spine to the sacro-iliac joint. The fossa is

FIG. 17.



MALE PELVIS.

FIG. 18.



FEMALE PELVIS.

more shallow in the female. In the male, the iliac tuberosity is more developed, and projects farther back. The pubic spines are farther apart in the female. In woman all the diameters of the inlet are greater

than in man. This difference is especially marked as to the transverse diameter. The inlet in the female pelvis is rounder, due partly to the increase in the transverse diameter, and to the fact that the diameter is placed farther forward than in the male pelvis. The great sciatic notch is less open, and is deeper in man. In man, too, the points of the sciatic spines are in some cases within the postero-inferior iliac spines, but in woman they are always without. The distance between the sciatic spines is greater in the female. The pubic arch is more open in woman, measuring 75°; in man only 58°. In woman it is always rounded; the ischio-pubic tubercle is turned more outward, and the ischio-pubic ramus is concave at its middle. In the female the coccyx and sacrum are not so high, and are more flattened. The ischio-pubic foramen is not oval in man, and triangular in woman;[1] in woman it is relatively larger, and more oblique outward and below. The ischia are wider apart in woman, while all the vertical pelvic diameters are greater in man.

Thus, while there are marked distinctions between the male and the female pelvis, so that ordinarily there is no possibility of confounding the one with the other, yet in some instances[2] the points of difference are so slight that it is very difficult to decide whether a pelvis is male or female.

Differences depending upon Age.—The pelvis of the fœtus at term is much less developed than is the upper portion of the body; delivery is therefore easier. The greater prominence of the abdomen in infants arises from the imperfect development of the pelvis; at birth the greatest portion of the rectum and the bladder are contained almost entirely in the abdominal cavity, and do not assume their permanent position until

FIG. 19.

PELVIS OF A CHILD.

about the period of puberty. At birth the false is more developed than the true pelvis; the latter is straight and cylindrical. According to

[1] The late Dr. John Neill, of Philadelphia, proved this fact more than thirty years ago, though most works upon anatomy and some upon obstetrics still repeat the erroneous statement that the foramen is oval in the male and triangular in the female.

[2] Depaul.

Wood,[1] the *parallelism* of the lateral as well as of the anterior and posterior pelvic walls is sufficiently marked and general that it can be considered as a characteristic of the conformation of the infant pelvis, as is found to be the case with most of the lower animals, to which it imparts a square-sidedness. The antero-posterior diameter of the inlet is greater than the transverse diameter until the age of nine years, when it equals, then gradually exceeds it. The complete development of the pelvis, which is not accomplished before twenty years, is largely dependent upon the presence and activity of the internal sexual organs; if these are absent or undeveloped, the pelvis fails to assume the characteristics of the female sex.

Differences dependent upon Race.—Some anthropologists have regarded the pelvis as next in value to the skull in the indication of racial characteristics. Verneau suggests that it will one day be possible, by the comparison of pelves, to give, as by the comparison of crania, a classification of the human race.

The relative proportions of the conjugate and transverse diameters of the pelvic inlet present remarkable variations in different races, though, according to Professor Turner,[2] the form characteristic of the race is more fixed in the male than in the female pelvis, since in the latter there is, for sexual reasons, to a considerable extent, an approximation in form in different races. Nevertheless, the relation of these diameters has been chiefly studied in the female sex. In general, lessened transverse and increased conjugate diameters of the inlet seem characteristic of inferior races. Thus Garson,[3] incorporating the measurements given by Verneau with those made by himself, obtained an average conjugate of 106 millimetres in 49 European pelves, and a transverse of 134.5; while in 7 Australian pelves the average conjugate was 108.6, and the transverse 120. Verneau found that the pelvis of the Egyptian and that of the Laplander were each smaller than that of the French woman.

In no people,[4] however, has it been found that, where a sufficient number of pelves have been examined to make a just average, the conjugate exceeds the transverse diameter. Everywhere the form of the female pelvis indicates its part in labor when the fœtus is perfectly developed.

It is not improbable that a definite relation between the size and form of the fœtal head and those of the pelvis will be proved to exist in different races. With the progress of a race, with its greater intellectual and moral development, it is possible that there is a development *pari passu* of the pelvis. Broca has shown that the Parisian of to day has a greater cerebral capacity than the Parisian of the twelfth century; and that the skull of the latter had a greater capacity than the skull of the Greek of the Macedonian period, skulls of this period exhumed at Athens within a few years showing a decided inferiority. Now it is at least a probable conclusion that if the head has thus increased in size, the bony canal through which it is transmitted at birth has undergone a corresponding

[1] Todd's Cyclopædia of Anatomy and Physiology.
[2] Journal of Anatomy and Physiology, vol. xx. 1885.
[3] Ibid. vol. xvi. 1882.
[4] Professor Turner.

increase. Nevertheless, Spiegelberg[1] has remarked that "the opinion that the farther north a race is living the larger the pelvis, and also the other assumption, that an increase in size of the pelvis occurs with the increase of civilization of a race, is not proved; it would be more correct to state that favorable conditions of nutrition and activity are the basis of a well-formed pelvis."

Ploss[2] states that the habits and customs of a people and their mode of life undoubtedly have a certain influence in the formation of the prevalent pelvic type. The general nutrition, more particularly the supply of bone-forming material, is of importance. G. Fritsch found that a dwarfed, poorly developed pelvis bore a close relation to the general system of the Bushwomen and Hottentots. The pelves of the South African races present neither the typical male nor female form, but rather a combination of the male and female pelvis, as a rule approaching the male form. This results to some degree from the unfavorable conditions in which these people live, the entire skeleton never attaining that perfection found in a civilized people. It is asserted that the pelves of negresses born in America correspond more nearly to those of the European type, improvement of the general environment leading to better development of the entire osseous system.

Soft Parts of the Pelvis.—Those structures which line the pelvis and those which chiefly make its inferior wall are called soft parts.

On either side of the upper pelvis the iliacus and the psoas muscles are placed. The iliacus covers the entire iliac fossa; it arises from the anterior two-thirds of the iliac crest, from the anterior iliac spines and the space intervening, from the sacrum, from the sacro-iliac joint, and from the ilio-lumbar ligament, and is inserted into the external border of the tendon of the psoas. The psoas muscle has its origin from the sides of the bodies and the transverse processes of the four upper lumbar vertebræ, and from the last dorsal, descends to the base of the sacrum, fills up the depression on each side of the promontory, and thick, spindle-shaped passes along the innominate line, receives the fibres of the iliacus, then goes out of the pelvis between the ilio-pectineal eminence and the inferior iliac spine to be inserted into the entire surface of the less trochanter.

An aponeurosis called the iliac fascia covers the iliacus and the psoas muscles; it divides into two layers, and thus furnishes a sheath for the iliac vessels and lymphatic ganglia. The external iliac artery and vein lie upon the internal border of the psoas. The lumbar plexus is placed in the substance of the muscle; its most important branch, the crural, after emerging from the muscle, lies between it and the iliac muscle, and then passes from the pelvis below Poupart's ligament. It has been suggested that the presence of these nerves in the psoas explains the violent lumbar pains which women suffer in labor, for the weight of the uterus then presses upon them.[3]

So, too, the pain felt at the inner part of the thighs, when the head of the fœtus descends through the inlet, is explained by pressure on the obturator nerve at the base of the sacrum as it passes under the aponeurosis, this nerve furnishing branches to the adductors.

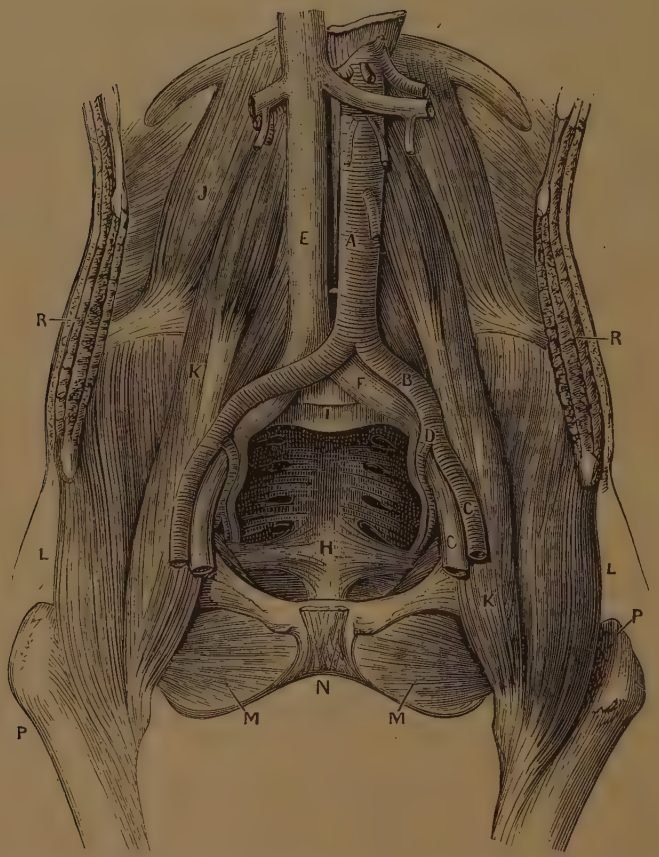
The psoas and the iliacus muscles acting from above flex and abduct

[1] Lehrbuch der Geburtshülfe. [2] Das Weib in der Natur und Völkerunde.
[3] Depaul.

the thighs; from below and on both sides they incline the lower portion of the spine and pelvis forward.

The iliacus muscle serves as a cushion upon which the gravid uterus rests. The psoas lessens the obliquity of the iliac bone, and makes the slope to the superior strait more uniform. The two psoas muscles and the vessels at their internal border lessen the inlet. The diminution

FIG. 20.



THE PELVIS WITH SOFT PARTS. (Bladder, rectum, uterus, and its appendages having been removed.)—*A*. Aorta. *B*. Primary iliac of left side. *C*. External iliac of left side. *D*. Internal iliac of left side. *E*. Inferior vena cava. *F*. Primary iliac vein of left side. *G*. External iliac vein of left side. *H*. Sacral insertion sacro-sciatic ligament. *I*. Sacro-vertebral angle. *J*. Quadratus lumborum. *KK*. Psoas muscles. *LL*. Iliac muscles. *MM*. External obturator muscles. *N*. Pubic arch. *PP*. Great trochanters. *RR*. Section of the muscles of the abdominal wall.

of the oblique diameters is only about one-eighth of an inch in each, but that of the transverse is three-fifths of an inch, or 1.5 of a centimetre. The diminution of the last diameter may be so great when the muscle is contracting as to prevent the entrance of the fœtal head.

In the pelvic cavity the pubic joint and the median surface of the

sacrum and of the coccyx have no muscular covering; but on each side the obturator internus and the pyriformis muscle are found, the tendon of the former passing out of the pelvis through the less, the latter through the great sciatic foramen, notably contributing to the closure of these openings. The nerves of the sacral plexus lie in front of the pyriformis. The bladder is placed in the anterior part of the pelvic cavity, behind the pubis, but its position varies in proportion to its fulness or emptiness. The rectum enters the pelvic cavity in front of the left sacro-iliac joint—thus slightly lessening the left oblique diameter of the inlet—passes obliquely to the middle of the anterior surface of the sacrum, and then descends in front of the sacrum and coccyx. The soft parts in the cavity make but slight change in its capacity. A full bladder or rectum may hinder the descent of the head in labor, and therefore the obstetrician is careful that each organ is emptied.

The Pelvic Floor.—Skin, connective-tissue, muscles, and layers of strong fascia unite to form the pelvic floor which contributes to the support of pelvic and abdominal viscera, and which at the same time is so formed that it may be temporarily opened almost to the bounds of the bony outlet, to permit the passage of the mature fœtus. This pelvic floor—diaphragm or inferior wall—is perforated by the urethra, vagina, and rectum; but these are closed, the first two by the accurate apposition of their walls, and the last by the contraction of the anal sphincter, unless when in functional exercise.

FIG. 21.

URO-GENITAL AND ANAL REGIONS IN WOMAN.—1. Gluteus maximus. 2. Levator ani. 3. Superficial transverse perineal muscle. 4. Profound transverse perineal muscle. 5. Vaginal sphincter muscle. 6. External anal sphincter. 7. Fasciculi of vaginal sphincter passing to the perineal body. 9. Ischio-cavernosus muscle. 10. Clitoris. 11. Bulb of the vestibule.

On examining the pelvic floor from within out we find, first, the superior pelvic aponeurosis, this aponeurosis being more or less covered, as

all the pelvic organs are, by peritoneum. It is simply the united fascia of the pyriform, internal obturators, ischio-coccygeal, and levator ani muscles; it is attached to the posterior part of the pubic joint, to the upper part of the sciatic notch, and to the sacrum at the inlet, and it is continuous with the iliac fascia. Beneath this aponeurosis are placed the levator ani and the two ischio-coccygeal muscles. The first has its origin, on either side, from the pubic ramus, the pelvic fascia, the ischial spine, and the less sciatic ligament; its fibres are inserted, first, at the base of the bladder, then in the vaginal walls, and in the coats of the rectum near the anus; the posterior fibres are inserted in a raphé extending from the tip of the coccyx to the anus. The broad muscular band thus formed makes a diaphragm concave above, convex below, for the pelvic cavity. It raises the anal orifice, and dilates it in defecation.

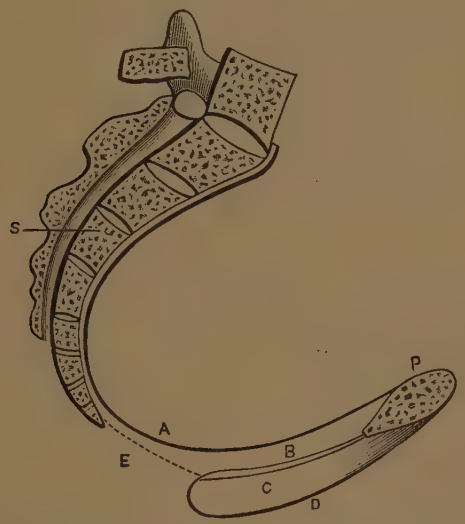
Budin, *Progrès Médical*, states that in exceptional cases the muscular fibres of the levator ani in the female may undergo remarkable development, so that its contractions can be readily felt by the finger in the vagina; in some cases making a tightly constricting circle, in other cases an elevation of the posterior wall of the vagina, so that it is drawn toward the anterior wall. In either case certain results may follow, such as difficulty or impossibility of sexual intercourse, and delay in the escape of the fœtus.

The ischio-coccygeus is in the same plane as the levator ani, lying between it and the pyriform; it is triangular in shape, the base being attached to the border of the coccyx and of the lower part of the sacrum, and the apex to the ischial spine. The two ischio-coccygeal muscles hinder the backward movement of the coccyx. They, with the anal levators, make the deep muscular layer of the perineal floor, and beneath the plane they form the anal sphincter is placed. This muscle has the form of an ellipse, the long diameter being antero-posterior; it arises by muscular fibres attached to the last bone of the coccyx and subjacent skin; these then form on each side of the arm a semicircular band, and, converging in front, are inserted in the perineal body. Beneath the sphincter is the skin.

The part of the pelvic floor thus described is called the posterior perineal region; it is triangular in form, the apex of the triangle being at the tip of the coccyx, and its base a line between the ischial tuberosities. The anterior perineal region is included between the line just mentioned and the pubic joint. The pelvic floor is here formed of skin, fasciæ, and muscles. The latter are seven, viz., one vaginal sphincter, and two ischio-cavernosi, two transverse perineal, and two ischio-bulbous. The vaginal sphincter arises from the perineal body, surrounds the vaginal orifice, and is inserted upon the body of the clitoris and its suspensory ligament. The ischio-cavernosus has its origin on either side from the ischial tuberosity and from the ischio-pubic ramus, and is inserted by two tendinous expansions, one above and the other below the union of the crura of the clitoris. The transverse perineal muscles arise from the ischial tuberosities below the preceding, and are inserted in the perineal body. The ischio-bulbous muscle passes from the ischium on each side to the bulb of the vagina. Three aponeurotic planes are found in the anterior perineal region—

the deep, the middle, and the superficial. Between the last two the muscles just described are placed.

FIG. 22.



ANTERO-POSTERIOR SECTION OF THE APONEUROSES OF THE PERINEAL FLOOR.—*S.* Sacrum. *A P.* Pelvic aponeurosis. *B.* Deep perineal aponeurosis. *C.* Middle perineal aponeurosis. *D.* Superficial perineal aponeurosis. *E.* Connective-tissue layer which covers the lower surface of the levator ani behind the bis-ischiatic line, where it is fused with the posterior border of the deep perineal aponeurosis. *P.* Pubis.

Perineum.—This part of the pelvic floor is of especial interest to the obstetrician. It is bounded by the anus behind, by the ischial tuberosities on the sides, and by the vulval opening in front. These limits apply to its external surface only. It has also a vaginal and a rectal surface, so that a median section of the perineum would very closely resemble in form a spherical triangle.

The distance from the anal to the vulval opening is about three centimetres, or a little more than an inch, according to Spiegelberg. Foster[1] found that in the parous this measurement was rather less than an inch, 2.7 centimetres, but in the nulliparous somewhat more than an inch. The hypertrophy of pregnancy may increase this measurement to an inch and a half, or four centimetres. In labor the perineum may be so stretched by the presenting part as to measure five inches and a half, or fourteen centimetres. It is generally held that this distensibility depends "upon an irregularly limited mass of elastic tissue and muscular fasciculi, situated midway between the posterior commissure of the vulva and the anus," known, since the investigations of Henle and Savage, as the perineal body. According to Savage,[2] the greatly stretched perineal body is the final covering of the presenting part. In very fat women the perineum does not yield readily in labor, and hence the liability to its rupture; while in some other patients it yields

[1] American Journal of Obstetrics, 1880. [2] Anatomy of the Female Pelvic Organs.

too readily, and its anterior margin is prolonged toward the pubic arch, while its central portion is so thinned that perforation may occur in it.

Pubic, and Sacral Segment of the Pelvic Floor.—The pelvic floor, in its relations to labor, is divided by Hart[1] into two parts, designated respectively the pubic and the sacral segment. The anterior vaginal wall is the posterior boundary of the former segment, and the posterior vaginal wall the anterior boundary of the latter segment. In labor the anterior segment is drawn up, while the sacral segment is forced down; and thus, as two doors meeting at their free border are opened, the one by drawing it toward the passenger, the other by pushing it from him, so the pelvic floor is opened for the transmission of the fœtus.

The vagina passes through the pelvic floor parallel to the conjugate of the inlet.

The Dynamic Pelvis.—From the parallelism of the vagina, as it passes through the pelvic floor, with the antero-posterior diameter of the inlet, it necessarily follows that if the presenting pole of the fœtus enters the inlet in a line perpendicular to its plane, the emergence of that pole from the vagina will be in a line perpendicular to the prolonged previous line. Hence, according to the view of Broissard and some others, a curved line does not represent the line of direction taken by the presenting part in passing through the birth-canal, or the dynamic as distinguished from the osseous or static pelvis. Further, as has been shown by Fabbri and Pinard,[2] a cast of the entire pelvis, that is of the bony pelvis with the membranous canal formed at the expense of the soft parts, a membranous canal channelled in all the thickness of the perineal floor, which is greatly developed at the period of expulsion connected with the former, will make it evident that the completed pelvic cavity is not a curved but chiefly a cylindrical canal. This cavity has its fundus at the coccyx, and the presenting part of the fœtus descends in a straight line to the fundus. But the cavity, while there closed, presents an opening upon the anterior wall, and the line of direction now becomes one nearly perpendicular to the line of descent.

[1] Female Pelvic Anatomy. [2] Broissard, op. cit.

CHAPTER II.

THE FEMALE SEXUAL ORGANS.

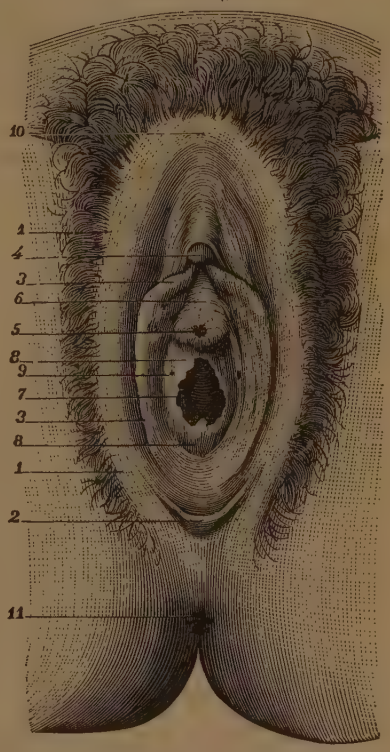
THE female sexual organs are divided into those of generation and those of lactation. The organs of generation are the external and the internal.

The External Organs of Generation.—These are included in the word pudendum or pudendum muliebre. Vulva[1] is often used as a synonym, though this term does not, strictly speaking, include the mons veneris.

Mons Veneris.—This is the upper part of the pudendum, and is bounded above by the hypogastrium, by the groin on either side, and by the greater lips below. It measures three inches from side to side, and two inches from above down—7.6 by 5 cm. A very large number of hair follicles and sebaceous glands are found in the skin covering the mons. The growth of hair occurs at puberty, and hence the name for the bony part upon which the mons is placed. Beneath the skin there is a thick layer of connective and adipose tissue, which is traversed by fibres of elastic tissue passing in various directions. Part of these fibres are connected with the superficial abdominal fascia. Some muscular fibres from the round ligament also enter this organ.

Labia Majora.—The greater lips, or alæ,[2] are two folds of skin passing from the median line and just below

FIG. 23.



VULVA OF THE VIRGIN.—1. Greater lip of right side. 2. Fourchette. 3. Small lip. 4. Clitoris. 5. Urethral orifice. 6. Vestibule. 7. Orifice of the vagina. 8. Hymen. 9. Orifice of the vulvo-vaginal gland. 10. Anterior commissure of greater lips. 11. Anal orifice.

[1] Vulva is from the word *volvo*, and was originally spelled *volva*; it meant the womb, or covering of the unborn animal. Vulva has no connection with *valva*, though the latter is derived from the same root.

[2] Winslow, in his Anatomy, says: "The ancients called the lateral parts of the cavity *alæ*, which is a more proper name than that of *labia* commonly given them."

the mons veneris on each side of the vulval entrance to meet in the middle and anterior part of the perineum. Their junction above is about half an inch, or one centimetre and a half above the clitoris, and is the anterior commissure. Their junction below, or posterior commissure, is simply a fold of cutaneous tissue marking the anterior margin of the perineum, and is called the fourchette. The depression between the fourchette and the hymen is called the navicular fossa.

The external surfaces of the labia majora are convex, and somewhat darker than the adjacent skin. They have an abundant supply of hair-follicles and of sebaceous and sudoriparous glands. The growth of hair, which, like that of the mons veneris, occurs at puberty, is remarkable at the upper part, but lessens as the labia descend to the perineum. The internal surfaces of these organs are plane, somewhat pink or rose-colored, and in children, in virgins, and in the fleshy are in direct contact; but in those who have borne many children, in the old, and in the emaciated, are separate, flabby, and relaxed, seeming like folds of dark and wrinkled skin, and expose the vulval entrance. The anterior borders are round and prominent, but become flattened and less distinct as they approach the posterior commissure. The posterior borders are attached to the ischio-pubic rami. Beneath the skin of the external surfaces and anterior borders of the labia there are found smooth muscular fibres forming that which Sappey has described as the dartos of the female, which is analogous to the dartos of the male. Each labium contains, according to Broca, a pyriform pouch, formed of elastic fibres, its large extremity being toward the posterior commissure, while its small end is directed to the inguinal canal. Sappey has described it as the elastic apparatus of the labia. The round ligament of the uterus, the analogue of the gubernaculum of Hunter, terminates in the labium majus. In some cases a prolongation of the peritoneum, forming the canal of Nuck, which is normally closed before birth, accompanies the ligament, and an accumulation of fluid in this canal may occur analogous to hydrocele of the cord, and frequently described as hydrocele of women. Connective and adipose tissue, bloodvessels, lymphatics, and nerves complete the structure of the labia. The superior commissure of the labia forms an arch over the clitoris, and partially covers and protects this organ.

Labia Minora.—Two folds of skin are found at the inner surface of each labium majus, beginning about the middle of the base of each greater lip, and are called the lesser lips, or nymphæ. They extend above nearly to the clitoris, then each bifurcates; the lower divisions meet below the clitoris, but the upper, which are the larger, unite above this organ, forming the hood or preputium clitoridis. The nymphæ are rose-colored, and are without hair-bulbs, sudoriparous glands, or muscular fibres. A layer of connective tissue, containing numerous elastic fibres and bloodvessels, unites the folds of skin of each nympha. The labia minora are remarkable for their sensitiveness and for their rich supply of sebaceous follicles. There are, according to Sappey, one hundred of these glands to every square centimetre of the external surface, and one hundred and twenty to one hundred and fifty to every square centimetre of the internal surface. While remarkably sensitive,

and thus concerned in copulation, the nymphæ are not erectile organs. In parturition they contribute to the enlargement of the vulvar orifice.

The size of these organs is different at different ages. At birth they are quite prominent, because of the little development of the labia majora; at puberty the notable growth of the latter causes them to be hidden, though they also increase in size at that time, unfolding, according to the comparison of the Swedish botanist, Linnæus, like the petals of a flower. They may be elongated by traction, and thus elongated and hypertrophied, measuring some five inches, 12.6 centimetres, or more, form what has been called the apron of the Hottentots. If projecting beyond the labia majora they become brownish—in negresses, for example, they are then as dark as the skin. They were supposed to direct the flow of the urine, and hence received the name nymphæ.

Among some of the Orientals the nymphæ are quite large, hindering the entrance of the penis, and their partial excision was the circumcision of females. Cuvier states that in the sixteenth century missionaries in Abyssinia persuaded their converts to abandon the custom, but as girls could no longer find husbands the Pope authorized a return to it.

The Clitoris.[1]—Two crura, or branches—one attached to each ischio-pubic ramus—ascend, and converging meet in front of the pubic joint to form the body of the clitoris, this body consisting of two corpora cavernosa, analogous to the corpora cavernosa of the penis. It is fastened to the anterior and inferior part of the pubic joint by a suspensory ligament. Sappey asserts that from its connection with the pubic symphysis and with the nymphæ change in its position or in its curvature is impossible. Its anterior portion, small and rounded, covered by the prepuce above and on each side, below by the inferior layers of the dividing nymphæ, is improperly called the glans—it has no orifice, no glandular structure. The dimensions of the clitoris vary in different subjects, but according to De Sinéty the average length is about three centimetres, or a little more than an inch. The mucous membrane[2] of the clitoris, especially that which covers the glans, is very rich in nervous papillæ, containing corpuscles of Krause and Pacini.

In the first three months of intra-uterine life the clitoris is relatively so large that a mistake in the sex of the product of abortion is liable to be made. So too, hypertrophy of this organ in children and in adults explains some of the cases of supposed hermaphrodism.

The clitoris is the analogue of the penis; it is an organ concerned in copulation, but to regard it as the chief or exclusive seat of sexual passion is an error.[3] It has been asserted that the clitoris is hypertrophied by masturbation; but this is no more true than that males have hypertrophy of the penis from the same cause.[4]

[1] Three derivations of clitoris have been given: First, from κλειω, to shut up, because concealed by the labia; second, from κλειδοω, to lock, the vulva being closed, and the clitoris supposed to point to the keyhole, and from κλητηρ, *Doric*, κλειτορ, one who invites, here the clitoris *quæ invitat ad coitum.*

[2] De Sinéty.

[3] The anatomist Colombus called this organ *veneris amor et dulcedo.* A recent obstetric author, Saboia, seems to adopt the same view, for he says that the clitoris is the chief organ of voluptuous feeling in the female.

[4] Winckel.

The Vestibule.—The nymphæ, diverging as they descend from the clitoris, make the sides of a triangle, the base being the intervening margin of the vagina, and to the space thus included the name of vestibule is given: the triangle is equilateral, each side measuring about one inch, 2.5 centimetres. Just above the middle of the base of the triangle the orifice of the urethra, *meatus urinarius*, is found; this orifice is circular, and often presents an irregular, elevated, and rather firm margin, so that it may be thus recognized by the finger gently pressing upon it; there may also often be felt at the lower margin of the orifice a projection known as the urethro-vaginal tubercle.

Introduction of the Catheter.—A flexible rubber catheter is usually preferred when artificial evacuation of the bladder is necessary; the beak of the instrument and the forefinger having been oiled, the latter is introduced into the vagina and its palmar surface placed upon the lower part of the anterior vaginal wall in the median line; the catheter is now passed along the upper surface of the finger until it touches the margin of the vagina, and then a slight elevation of the point of the instrument brings it into the mouth of the urethra. Another method of introducing the catheter, though in some cases very objectionable because of the great sensitiveness of the clitoris, is to pass the finger from above, separating the nymphæ, down the middle line of the vestibule about four-fifths of an inch, when the surface, hitherto smooth, becomes irregular, uneven, and the orifice of the urethra being recognized, the catheter is readily passed.

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When coition occurs in girls before the development of the sexual organs, it is not uncommon to find the urinary meatus hidden under the pubic arch, a partial inversion of the vulva having been produced, and a similar displacement of the meatus is sometimes found in posterior displacement of the gravid uterus. On the other hand a reverse displacement of the meatus may be observed after a severe labor, and consequent great swelling of the parts—the meatus is then farther from the vaginal entrance, and lies somewhat obliquely with reference to the normal position of the plane of the vestibule: very rarely, however, is exposure necessary for catheterization.

Hymen,[1] *and Carunculæ*[2] *Myrtiformes.*—According to Budin,[3] the hymen as a distinct membrane does not exist; it is simply the lower

[1] From ὑμήν, a membrane.

[2] Not given this name from their resemblance to myrtle berries, as commonly taught, but from their resemblance to myrtle leaves as observed by Winslow.

[3] Budin's statement is upheld by Dr. Gustave Imbert in a monograph upon the development of the uterus and vagina. Dr. Imbert says, referring to the hymen: In view of its structure some admit that this membrane is formed by a fold of the mucous membrane of the vagina; others that it results from the vulval and vaginal mucous membrane being placed against each other. Properly speaking the hymen is nothing but the anterior extremity of the vagina covered externally by the vulval mucous membrane; this is proved not only by histological examination, but by a dissection which shows the prolongation of the columns and ridges of the vaginal mucous membrane upon its internal face, and up to the orifice of the hymen. When the vagina is isolated from connected parts, it appears as a canal ending in front by a perforated hemispherical part. Développement de l'Utérus et du Vagina. Paris, 1883. Dohrn states, Zeitschrift für Geburtshülfe und Gynäkologie, 1885, that the development of the hymen is closely connected with the increase in the length of the vagina, and that in proportion to this increase an excess of tissue is produced which takes the form of a fold projecting over the vaginal entrance; as the posterior wall of the vagina exceeds in growth the anterior, the first beginning of the hymen is seen upon the former, and here it has a broader base, while the hymenal opening is nearer the anterior vaginal wall.

end of the vagina, perforated like the extremity of the finger of a glove; or, it may be compared to the partially inverted and narrow fringed margin of a pantalette. But this view has not met general acceptance, and the following is probably the true explanation of the origin of the hymen:[1] About the nineteenth week of intra-uterine life, the first trace of the hymen appears as a slight projection on the posterior wall of the vagina, just above the point where the vagina unites with the uro-genital sinus. A smaller projection then appears upon the anterior vaginal wall, but somewhat higher. The two soon unite at the sides. Papillæ are found upon the internal surface of the hymen, but its external surface is smooth, like the vestibule. It is composed of fibrillated stroma of connective tissue, has arteries and veins, and is rich in elastic fibres; muscular tissue is found in it, and the presence of nerves is proved by its exquisite sensitiveness in some cases. Winckel thinks its purpose is to prevent the entrance of amniotic fluid into the genital canal during labor-pains. In some cases the hymen presents a crescent-form, and apparently occupies only the lower portion of the vaginal entrance; again, it may be a membrane with a single central opening, or with several small perforations like a colander, or, finally, it may completely close the vagina rendering discharge of the menstrual fluid, or entrance of the penis impossible. Rupture of the hymen usually occurs at the first sexual intercourse, but it may result from other causes, though it is impossible, as some have alleged, from any change of position of the lower limbs. If the vagina be large and greatly relaxed, the hymen may retain its integrity after repeated congress: occasionally it has been found an obstacle to childbirth, and its incision been necessary. Only a few drops of blood usually follow its rupture, but in some instances a severe hemorrhage has been thus caused.

The myrtiform caruncles, or hymenal tubercles, as Dubois termed them, are small fleshy tubercles, two to five in number, found after complete rupture of the hymen, at the part of the vagina formerly occupied by its circumference. They are not seen, according to Schroeder and Budin, until after labor, which converts the vagina and vulva into a common passage. They differ in size in different subjects, being so small in some as to be hardly visible, while in others they are relatively quite large.

Vulvar Canal and Navicular Fossa.—The vulvar orifice is usually closed by approximation of the labia majora, but upon separating them a space is seen, shallow above at the vestibule, much deeper below at the posterior commissure, having somewhat the shape of a funnel, the smallest part being at the vaginal entrance; this is the vulvar canal.

So, too, upon separating the labia there is distinctly seen in the nullipara, not, however, so apparent in the parous, a depressed surface extending from the fourchette to the hymen, or to the myrtiform caruncles; this depression has been given, from a fancied resemblance to a boat, the name of navicular fossa.

Vulvar Glands.—The glandular supply of the mons and of the greater and less lips has been stated; the richness of the nymphæ

[1] Winckel.

in sebaceous glands, not only keeps these parts soft and pliable, but also guards them against injury from the contact of urinary and of utero-vaginal discharges. But in addition to the glands previously mentioned, there are other vulvar glands to be noticed. Huguier has described four groups of muciparous follicles—though discredited by Sappey—vestibular, urethral, latero-urethral, and latero-vaginal. Skene[1] in 1880 gave a description of two glands situated just within the meatus upon each side, near the floor of the urethra; these glands are from three-eighths to three-quarters of an inch in length.

The vulvo-vaginal glands—also known as the glands of Bartholin, and of Duverney—are in the female the analogues of Cowper's glands in the male. They are situated at the sides and posterior part of the vaginal entrance, about two-fifths of an inch, or one centimetre above the anterior face of the hymen or of the hymenal tubercles, and just below the bulb on each side.

They vary in size, in some cases as small as a pea, in others as large as a hazel-nut; their usual form is that of a flattened ovoid. They are composed of lobes, lobules, and acini; from the acini canaliculi pass, which, lessening in number and increasing in size in their further progress, finally open in a single efferent duct. A covering of fibrous and connective tissue, sending prolongations between the lobes and lobules, invests each gland. These glands are lined with a cup-shaped epithelium closely resembling that of the glands of the cervical canal, and hence the similarity of the secretion, which is a tenacious, usually colorless fluid, that lubricates the vulvar orifice, and thus facilitates coition. In some females the secretion is discharged in a jet, and this fact led to the long since rejected belief that woman as well as man furnished semen in coition, and the new being was the product of the united discharges.

Bloodvessels, Lymphatics, and Nerves of the External Sexual Organs.—The arterial supply of these organs is by branches from the external and internal pudics, and the epigastric. The return of blood is chiefly through the external pudic veins. The lymphatic vessels communicate with the inguinal ganglia.[2] The nerves are from the external pudic nerves, and from the genito-crural and abdominal branches of the lumbar plexus.

The Internal Organs of Generation.—The internal organs of generation are the vagina, the uterus, the ovaries, and the oviducts.

The Vagina.[3]—The vagina is usually described as a musculo-membranous canal extending from the vulva to the uterus. From its continuity with the vulva it is an organ of copulation; and from its connection with the uterus it is an excretory canal for uterine secretions and the monthly flow, and through it as part of the birth canal the fœtus with its appendages passes. It is placed behind the urethra and the bladder, and in front of the rectum; it passes from the uterus

[1] American Journal of Obstetrics.

[2] "It ought not to be forgotten that the superficial lymphatics of the groin have a double communication with those of the iliac fossa by vessels which pass through the cribriform fascia to reach the deep lymphatics, and by the ganglion which generally occupies the orifice of the inguino-crural canal."—*Siredey.*

[3] Vagina means a sheath. The old anatomists called the vagina the cervix, and the ostium uteri; even Dionis and Mauriceau described it as the neck of the womb.

obliquely from above downward, and from behind forward. It forms an obtuse angle with the uterus when the bladder is full, but if the latter be empty, a right angle. Its posterior wall is about four inches, or ten centimetres in length, while its anterior wall is a little more than three inches, or eight centimetres. But these are only approximate measurements, for the length of the vaginal canal varies in different subjects, and at different ages; it has been stated that in the negress this canal is longer than in the white woman; it is relatively longer in the new-born than in the adult,[1] the proportion to the length of the body being in the former one to nine, while in the latter it is one to fifteen.

When the organ is at rest the anterior rests upon the posterior wall, the two being in immediate contact, so that a section would represent a transverse slit, rather than a cavity. Nevertheless it is usual to refer to the vaginal diameters. The calibre of the vagina is least at the vulva, and gradually increases as the organ ascends to the uterus, so that were the vaginal walls held apart it would represent not a hollow cylinder, but a hollow truncated cone, the base of the cone being above; the mean antero-posterior and transverse measurements are in the nulliparous from rather more than an inch to an inch and a half, three to four centimetres; in the parous two inches and a quarter to two inches and a half, or about six to seven centimetres. But in labor, the vagina is so greatly stretched that these diameters become nearly equal to those of the pelvis.

The anterior wall of the vagina is in relation with the urethra the bas-fond of the bladder, and with the ureters. The connection between the vagina and the urethra, especially at the inferior portion of the latter is very intimate, and interchange of fibres takes place; that between the vagina and bladder is of looser connective tissue, in which numerous blood and lymph vessels are found. Posteriorly the vagina is in relation with the peritoneum[2] nearly four-fifths of an inch, or somewhat less than two centimetres; the descent of the peritoneum from the posterior wall of the uterus to be reflected over the anterior wall of the rectum forming a pouch variously known as Douglas's, the recto-uterine cul-de-sac, and retro-uterine cul-de-sac. The subperitoneal tissue is here quite thin. Below the cul-de-sac the vagina is in relation with the rectum, but the connective tissue uniting the two above is quite loose, so that intra-peritoneal effusions may cause great descent of the peritoneal pouch. From the curving forward of the vagina below, and curving backward of the rectum, these organs are there placed farther apart, so that a section of the recto-vaginal wall, made antero-posteriorly, would have the form of a triangle, its base extending from the anus to the vulva, and its apex being immediately below the cul-de-sac. Laterally the vagina is in relation with the vaginal bulbs and sphincter, connective and fatty tissue, the anal levator, the lowest portion of the broad ligaments, and the pelvic aponeurosis.

At its upper end the vagina is continuous with the uterus by means of muscular fibres common to the two organs, and by mucous mem-

[1] Huschke.

[2] According to Bayer (Morphologie der Gebärmutter) the peritoneum may pass from the uterus at the same height upon the posterior as upon the anterior wall, and in such case of course the above statement would not be correct.

brane continuous from one to the other. This connection is made at the junction of the lower with the middle third of the uterine neck, a little higher behind than in front, and the neck is thus divided in two parts, one intra-vaginal, the other supra-vaginal; the former is by some called the *portio vaginalis* or vaginal portion.

In consequence of the vaginal walls arching over to unite with the uterus a dome or vault, sometimes called the vaginal fornix, is formed; this vault is divided into two lateral cul-de-sacs, distinguished as right and left, and one anterior, and one posterior; the last is the deepest.

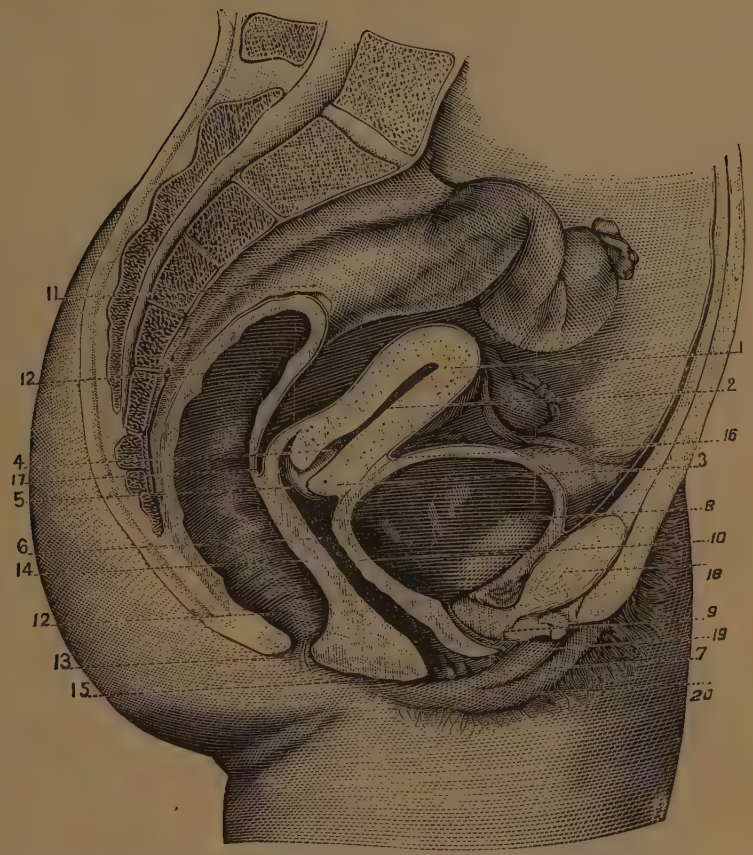
The vaginal is continuous with the vulvar canal below; as the union between the two is made at the narrowest part of each, a strait is formed which is in some cases the cause of serious delay in childbirth. The anterior and posterior walls of the vagina present transverse elevations, those on the former being more prominent than those on the latter. These elevations, sometimes improperly called *rugæ*,[1] are more distinct at the entrance of the vagina, and gradually lessen until they disappear a little above the middle of the canal; those on the posterior wall in many cases ascend higher than those on the anterior wall. Labor temporarily effaces them, and after it, though gradually reforming, they are never as distinct as in the nulliparous. Two longitudinal elevations are formed at the junction of the transverse ridges in the median line, one on the anterior, the other on the posterior vaginal wall, that on the former being the more prominent, which are called the vaginal columns, and also the *columnæ rugarum.* Neither the columns nor the rugæ are directly opposite, and thus a more complete apposition of the walls is secured. At the lowest portion of the anterior column, a projection is observed, *tuberculum vaginæ;* this is important as a guide to the urethral opening, which is just above the tubercle.

The walls of the vagina are from one-eighth to one-sixth of an inch, three to four millimetres, in thickness. They are composed of three coats or layers, the external fibrous, the middle muscular, which makes two-thirds of the thickness of the wall, and the internal mucous. The first is formed of connective tissue and elastic fibres; it contains large bloodvessel branches and nerve-tracts. It is in relation externally with the organs which encircle the vagina, and internally with the middle coat. The arrangement of the muscular fibres composing the middle coat is given differently by different authors. According to Henle, the external layer is circular, and the internal longitudinal, while Luschka gives a reverse disposition of these fibres, the longitudinal being external, the internal circular, and between the two oblique fibres are found. Tarnier describes the muscular fibres as inserted below in the ischio-pubic rami, and continued above with the middle of the three muscular layers of the uterus, some extend into the utero-sacral ligaments, and others cross each other in all directions, leaving spaces occupied by venous enlargements.

The mucous membrane is pale red ordinarily, but during menstrua-

[1] "These projections have been regarded as simply folds of the mucous membrane which are effaced in coition, and especially in labor. But they are not at all similar to folds. They are prolongations, elevated above the walls of the canal . . . . and do not contribute to enlargement of the vaginal cavity, but to coition."—*Sappey.*

FIG. 23.



SITUATION AND RELATIONS OF THE UTERUS.[1]—1. Body of the uterus. 2. Cavity. 3. Neck. 4. Cavity of the neck. 5. Intra-vaginal part of the neck. 6. Vagina. 7. Vaginal orifice. 8. Bladder. 9. Urethra. 10. Vesico-vaginal wall. 11. Rectum. 12, 12. Rectal cavity. 13. Anus. 14. Recto-vaginal wall. 15. Perineum. 16. Vesico-uterine cul-de-sac. 17. Utero-rectal cul-de-sac. 18. Pubic symphysis. 19. Small lip. 20. Great lip.

tion, and especially in pregnancy, becomes violet-colored. Very numerous microscopic papillæ supplied with bloodvessels are found in the lower part of the vagina, but are scanty in the upper part. While it is commonly stated that the vaginal mucous membrane is covered with pavement epitheliŭm, according to v. Preuschen the lowest layer shows cylindrical epithelium. By Sappey and most other anatomists the presence of glands in the mucous membrane of the vagina is denied, but the investigations of v. Preuschen, confirmed by those of Ruge, seem to prove their existence. They are not abundant,

FIG. 24.

SECTION OF THE MUCOUS MEMBRANE OF THE VAGINA; showing cylindrical cells.

[1] In taking this plate from Sappey, some slight changes have been made so as to represent the vaginal walls nearer together.

and are similar in form to the sebaceous follicles of the vulva; in the superficial portion of the sinuous duct pavement epithelium is present, but deeper, as in a section of the mucous membrane of the vagina, cylindrical epithelium is found, while in the remaining part of the gland both pavement and ciliated cylindrical epithelium occur.

Vessels and Nerves of the Vagina.—The arterial supply is chiefly through the vaginal—derived from the anterior branch of the internal iliac—and from branches from the uterine, inferior vesical, and internal pudic. The veins, which are many and large, empty into the venous plexuses, situated at the sides of the vagina. The lymphatics of the lower fourth of the vagina, uniting with those of the vulva, communicate with the ganglia of the groin, while those of the remaining three-fourths enter the lateral pelvic ganglia. The nerves are derived from the hypogastric plexus.

The Bulbs of the Vagina.—These are two erectile organs placed upon the anterior and lateral parts of the vagina; they are below and within the pubic rami, their internal concave surface embracing the vaginal orifice, their external convex surface being covered by the bulbo-cavernosus muscle. Above, the bulbs are united by veins and muscular fibres; the anterior borders have veins communicating with the veins of the nymphæ and of the clitoris. A bulb has been compared by Kobelt to a leech gorged with blood. According to Savage, a single bulb when filled with blood is an inch and a half long, and half an inch thick, while the measurements given by Sappey, and by Tarnier and Chantreuil, and by Charpentier are: length, one inch and one-tenth, thirty-five millimetres; breadth, half an inch, fifteen millimetres; thickness, three to four-tenths of an inch, or ten to twelve millimetres.

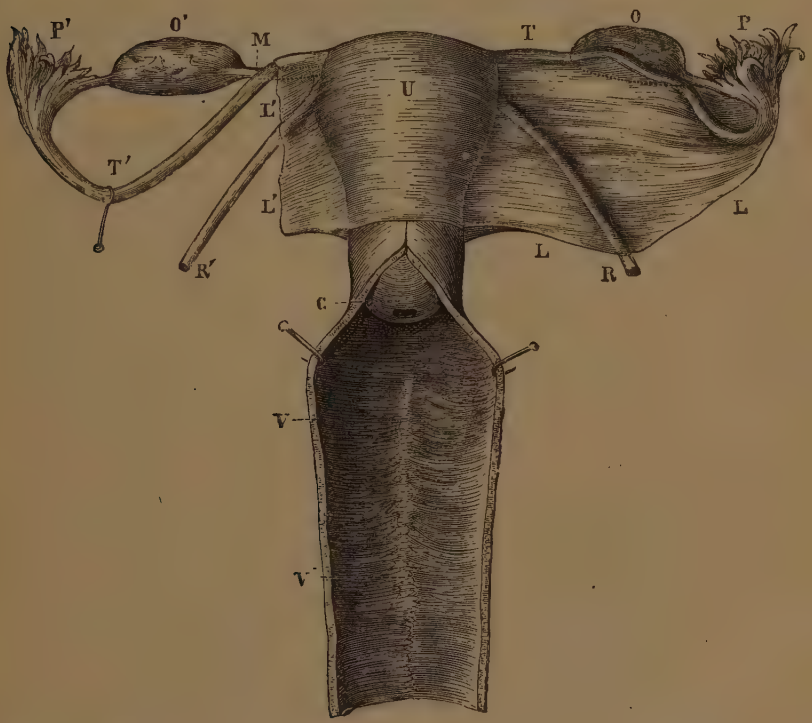
FIG. 25.

BULBS OF THE VAGINA.—*A*. Clitoris. *B*. Bulbs. *C, D*. Right and left halves of the vaginal constrictor.

The Uterus.—Womb, *matrix* from the Latin *mater*, Greek, μητερ μητρα, German, Mutter, and Gebärmutter. The Greek μητερ, the Latin mater, the Sanscrit *matri*, and German *Mutter* show a striking analogy with the word "mut," which, according to the famous Egyptologist, Professor Ebers, was used in ancient Egypt as the name of the womb. The uterus is the organ in which the impregnated ovule is developed, and by which the fœtus and its appendages are expelled from the mother's body when the development is complete; it is, therefore, the organ of gestation, and the organ of parturition. It is situated in the pelvic cavity with its fundus usually just below the plane of the inlet; it is behind the bladder and in front of the rectum, while at its sides are the broad ligaments which pass from it to be attached to the lateral walls of the pelvis. The uterus has been by some described as pear-shaped, and by others as resembling a gourd; that portion which

lies above the reflection of the peritoneum over the posterior wall of the bladder presents somewhat the form of an inverted truncated cone, while that which is below is cylindrical. A slight depression or constriction upon its external surface, more distinct in the virgin than in the parous uterus, more distinct too, anteriorly than posteriorly, known as the isthmus, marks the separation just mentioned; all that part of the

FIG. 26.



INTERNAL GENITAL ORGANS.—*C.* Anterior part of the neck of the uterus. *L.* Broad ligament of left side. *L'.* Part of broad ligament of right side. *M.* Ligament of right ovary. *O.* Left ovary. *O'.* Right ovary. *P.* Pavilion of left oviduct. *P'.* Pavilion of right oviduct. *R.* Round ligament of left side. *R'.* Round ligament of right side. *T.* Left oviduct. *T'.* Right oviduct. *U.* Body of uterus seen from anterior face. *V.* Vagina opened from above below. *V'.* Middle column of posterior vaginal wall.

organ above the isthmus is called the body, or corpus, while that below is the neck, or cervix. If a line be drawn from the uterine end of one oviduct to that of the other, the portion of the body or corpus above this line is known as the fundus. In infancy and in childhood the uterus is small, but it is remarkably developed at puberty; it is atrophied after the menopause; it is temporarily increased in size one-half or more, during menstruation; it is larger in the parous than in the nulliparous, larger, too, in the married than in the virgin. The virgin uterus is about two inches and a half, or seven centimetres in length, its greatest lateral measurement is about one inch and a half, or four centimetres, and its antero-posterior measurement is nearly one inch, or two and five-tenths centimetres.

Its weight in the nullipara is from eight to ten drachms, or thirty-two to forty-two grams. The weight of the parous uterus is from one-fourth to one-third greater.

The anterior face of the uterus is triangular, slightly convex; the posterior face, which is also triangular, is decidedly convex; its superior border is convex from before back, nearly straight from side to side in the nulliparous, but convex in the parous uterus; the sides curve somewhat inward from above down, and are convex from before back. The angles of the uterus mark the union of the superior border with the lateral borders; they also correspond with the attachment of the oviducts. The lower end of the body of the uterus is continuous with the upper end of the neck, the isthmus marking the place where one passes into the other.

The relative proportions of the body and the neck differ in the child from those in the adult; so too this relation differs in the nulliparous and in the parous. In the child at birth, and for the first following years, the neck is three-fifths of the entire organ, but in the nulliparous only a little less than half; in the parous the body is three-fifths to two-thirds the entire uterus.

The cervix in the virgin has nearly the form of a cylinder; it is, however, somewhat enlarged in the middle like a barrel, and flattened from before back so that the antero-posterior diameter is a little less than the transverse. It is commonly stated that the upper third of the anterior surface of the cervix is covered by peritoneum, while the middle third is attached to the bladder; the investigations of Bayer, however, show that the peritoneum is usually reflected from the anterior wall of the uterus at a point corresponding with the internal os uteri, and, therefore, this membrane does not cover any portion of the cervix anteriorly. The vaginal portion of the neck—its lower third—in the virgin is smooth; as it descends it lessens in size, and is rounded at its lowest part; in the middle of this rounded part an opening, the os uteri, is found having usually the form of a short transverse slit, which becomes circular when mucus or blood is expelled; to the finger it feels like a simple depression. In the normal form of the virgin cervix any division of the tissue surrounding the mouth of the womb into an anterior and a posterior lip is purely arbitrary, in most cases nothing can be seen or felt but a uniform unbroken border; the distinction of anterior and posterior lip is almost invariably the result of a traumatism in labor, and this result is usually physiological not pathological. In quite rare cases, however, labor may occur without any tears of the os, so that the latter retains its virgin character. So too, in some cases where the fashionable operation for laceration of the cervix has been done, the skill of the operator may have perfectly restored the original form of the os Hence an obstetrician, finding an os with the virgin form, in consequence of no tear having occurred at childbirth, or because perfect restoration has been made by an operation, may incorrectly conclude that the subject has never borne a child. The cervix in the parous is not conical as in the virgin, but often club-shaped, the mouth larger and fissures can be seen and felt, the most distinct usually being transverse; that upon the left side is more invariable and gener-

ally more distinct, and its greater depth and more uniform presence is explained by the greater frequency of left occipito-anterior positions. Child-bearing also shortens the neck of the womb, and in a woman who has had many children the vaginal portion of the neck may be so lessened as to scarcely project in the vagina.

The cavity of the uterus is divided into that of the body and that of the neck, the dividing line being a narrowed part corresponding internally with the isthmus externally; this internal narrowed part is known as the *os uteri internum*, the internal mouth of the womb.

The Cavity of the Body of the Uterus.—The cavity of the body of the uterus is triangular, the angles being at the entrance of the oviduct on each side, and at the internal os uteri. The sides of this triangle are convex, the curve being toward the centre of the cavity in the nulliparous; the sides are straight, or even curved somewhat outward in the parous. The anterior and posterior walls are in contact, or else separated by only a thin layer of mucus. The capacity of the uterine cavity in the nulliparous is from 2 to 3 cubic centimetres or 32 to 49 minims; in the parous 3 to 5 cubic centimetres, or 49 minims to 1 drachm, 21 minims.

The Cavity of the Neck.—The cavity of the neck is fusiform; but this character is less distinct in the parous than in the virgin. The anterior and posterior walls have each a longitudinal projection, the two projections not, however, directly opposite; from each of these as a central axis similar projections, *plicæ palmatæ*, pass obliquely on either side:

FIG 27. FIG. 28.

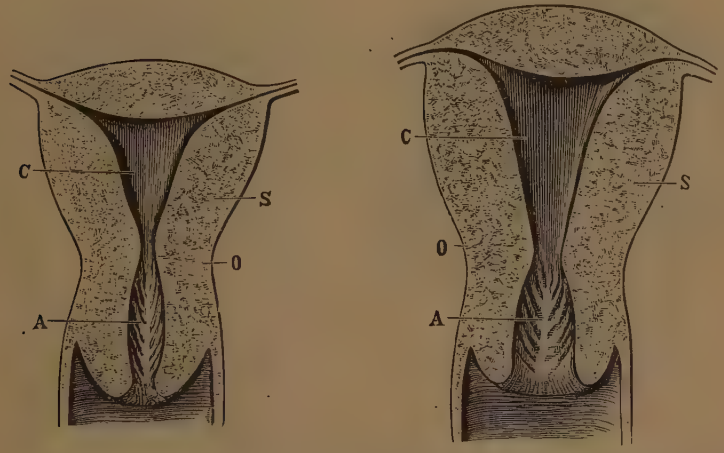


Fig. 27. TRANSVERSE SECTION OF A NULLIPAROUS UTERUS. Fig. 28. TRANSVERSE SECTION OF A MULTIPAROUS UTERUS.—*A*. Cavity of the neck and arbor vitæ. *C*. Cavity of the body. *O*. Isthmus separating body and neck. *S*. Uterine tissue.

each axis with its branches forms an *arbor vitæ—arbor uteri vivificans* was the name given it by the old anatomists. In addition to the median ridges or columns, there is one on each side at the junction of the anterior and posterior walls.

The Structure of the Uterus.—The walls of the uterus are composed of an external serous, an internal mucous, and a middle muscular coat. The thickness of the uterine parietes varies at different parts from four-thirteenths to seven-thirteenths of an inch, eight to fifteen milimetres; the wall is thinnest at the entrance of the oviducts, thickest at the sides.

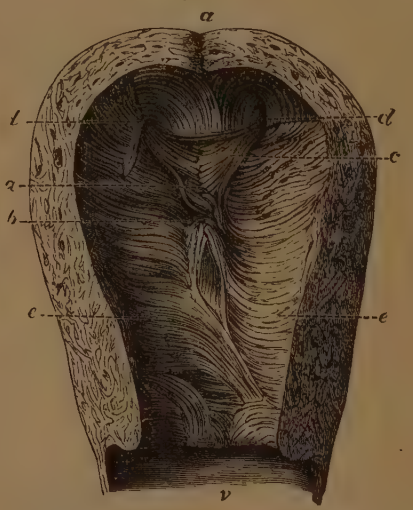
The Peritoneal Coat.—All the uterus is covered with peritoneum except its borders, that part which is within the vagina, that is the vaginal portion, the part connected with the bladder, and that to which the vagina is attached. The union is so intimate upon the anterior and upon the posterior face of the uterus, that even a small part of the serous cannot be removed without taking away also a thin layer of muscular tissue. The peritoneum is reflected from the uterus in front over the bladder, and in this reflection the vesico-uterine cul-de-sac is formed; its reflection posteriorly over the rectum forms the retro-uterine cul-de-sac, the lowest portion of the peritoneal cavity; laterally the anterior and posterior layers of the peritoneum which include the uterus meet to form the broad ligaments.

In some cases the posterior peritoneal reflection begins upon that part of the posterior surface of the cervix which corresponds with the internal os; in most, however, the peritoneum descends so as to be in relation for a short distance with the upper posterior vaginal wall, and then is reflected over the rectum.

FIG. 29.

EXTERNAL MUSCULAR LAYER OF POSTERIOR WALL OF UTERUS.

FIG 30.



INTERNAL MUSCULAR LAYER.—*a*. Section of uterine wall. *b*. Triangular bundle. *c*. Fibres returning to the tubes. *e, e*. Transverse fibres. *v*. Vagina.

The Muscular Coat.—This is the most important of the three, and makes almost the entire thickness of the uterine wall; the uterus is in fact a hollow muscle. The muscular tissue of the non-pregnant uterus

is firm, resisting, has a grayish, or reddish-gray color, and when cut creaks like firm fibrous tissue. But this organ in pregnancy shows marked changes in its muscular substance. The tissue is now softened, very vascular and red; in consequence of both hypertrophy and hyperplasia its muscular character has become quite distinct.

Most authors describe the muscular wall of the uterus as composed of three layers, one external, a middle, and an internal. The usual description will be briefly given first, and then some results of recent studies of this wall will be presented.

The external layer is formed by alternate planes of transverse and longitudinal fibres.

On the posterior wall transverse bundles are found beginning at each side at the level of the isthmus; running across toward the median line, they then turn abruptly to become longitudinal; fresh accessions to the latter come from the inflection of other fibres from either side in the ascent from the isthmus toward the fundus. The median portion of the bundles of longitudinal fibres pass over the fundus, but the fasciculi cross each other, those from the left passing to the right, and similarly the right passing to the left, to descend upon the anterior wall; the lateral bundles pass off to the broad ligaments and to the oviducts.

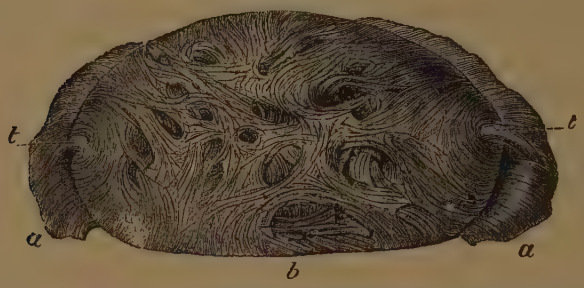
The deep or internal layer is chiefly formed of orbicular fasciculi, having the openings of the tubes as centres, and arranged in concentric circles. At the level of the isthmus more or less complete rings are found, making a sphincter. There also enter into the formation of this coat two triangular fasciculi, one on the anterior, the other on the posterior wall; the base of each triangle is at the fundus, and its apex at the isthmus; these fasciculi begin in transverse fibres below, and end in transverse fibres above, so that the general course of the twice inflected fasciculi is represented by the letter Z; but the course of the fasciculi upon the anterior wall is the reverse of that of those upon the posterior wall, that is it would be represented by an inverted Z.

The middle layer, found only in the body of the uterus, is as thick as the two others united. Tarnier gives the following description: It is composed of bands of variable size which cross each other in every direction; some are transverse, others oblique, some longitudinal; large apertures, traversed by veins and sinuses, separate these bands from each other, or separate the fibres of the same band. Muscular fasciculi are curved around the uterine veins (the arciform fibres of William Hunter, 1772; fibres *in anse* of Calza, 1807), and each curve crossed by another forms with it a complete ring which encircles the vein. A series of these rings forms a canal for the vein. Large rings, similar in their formation to the preceding, encircle several veins at a time, and each of these in the chief ring also has its own ring. Most frequently the curved fasciculus forms only one-half or two-thirds of the circle, which another fasciculus completes by crossing the first, with which it is intimately united. Each venous vessel is thus encircled by contractile annular fibres, and passes in a true contractile canal in all its course through the middle layer.

The muscular tissue of the neck is derived solely from the external

and from the internal layers. Its superficial muscular plane is formed exclusively of transverse fibres, the fasciculi crossing each other at the median line according to Schwartz; but Tarnier and others describe them as passing somewhat obliquely. Muscular fibres pass from the

FIG. 31.



MIDDLE MUSCULAR LAYER AT THE FUNDUS.—*a, a.* Superficial layer dissected back. *b.* Branches belonging to the inner layer. *t, t.* Tubes.

neck to the vagina, to the utero-sacral, and to the utero-vesical ligaments. Immediately beneath the mucous membrane of the cervical canal, fibres of muscular tissue are found. The projections of the *arbor vitæ* are formed by muscular fasciculi, whose fibres separate on each side in making the superposed arches.

Bayer, from a very careful microscopic study of the muscular structure of the non-gravid uterus, has been led to the following conclusions:—

1. The internal longitudinal fibres of the oviducts form the largest part of the submucous muscular layer of the uterus, while their external longitudinal layers form a part of the external layer. The circular fibres of the oviducts assist in the formation of the middle muscular layer of the uterus.

2. The greater portion of the muscular tissue of the lower pole of the uterus and of the cervix is developed from the *retractors*.[2]

The lowest and thickest part of the posterior wall of the corpus, a thinner and higher zone on the anterior wall, the whole of the lateral wall of the cervix, as well as the anterior lip, and the portion of the cervix immediately above it, may be traced to this origin.

3. The remaining portion of the uterine fibres is derived from the radiating fibres of the round ligament, and, indeed, the chief mass of the posterior wall of the body from the retractors; and the muscle bundles surrounding both angles of the womb in diverse layers are derived from the ovarian ligament; on the other hand, the external layer of the anterior wall and the lower part of the cervix, and the entire supravaginal part leads back to the round ligament. The middle layer of the body is formed by both ligaments in common.

It will thus be seen that a general division of the muscular mass of the womb into three or more layers is not feasible, since the arrange-

[1] Morphologie der Gebärmutter. Freund's Gynäkologische Klinik. Strassburg. 1885.
[2] See description of the utero-sacral ligaments.

ment of the muscular layers is diverse in different parts of the uterus. Its construction can only be understood by examining the several portions of the uterus separately.

1. The fundus is composed of—

(*a*) A superficial layer, the median longitudinal fibres of which pass from in front back, while the lateral fibres are arranged in whorls around the insertions of the oviducts; these whorls pass from left to right around the right tube, from right to left around the left tube, compared with the direction in which the hands of a watch move; a hood-like covering is thus formed, probably arising from the external longitudinal layer of the oviduct, and of the round ligament.

(*b*) Of the deepest, or submucous layer, arranged in the same manner as the above, and derived from the internal longitudinal fibres of the oviduct.

(*c*) Of a middle layer, which is derived from the round and from the ovarian ligaments, a broad band, anteriorly and posteriorly, on both sides of the median line, passing in a sagittal direction. This is interlaced with transverse bands from the circular fibres of the oviducts. Fibres from the ovarian ligament, in connection with the latter, surround the horns of the uterus in spirals and obliquely placed circulars.

2. The posterior wall is formed by the circular fibres of the oviduct, by diagonal lamellæ from the ovarian ligament, which pass inward from above, and, finally, by the eccentric rings coming from the retractors, which penetrate all the layers. In this description the most superficial and the deepest longitudinal fibres originating from the oviducts, and which unite to form anteriorly and posteriorly a triangular muscle, are omitted.

3. The middle part of the anterior wall may be divided into an external longitudinal layer, which arises from the muscular fibres of the round ligament, united with the longitudinal fibres from the oviduct; a middle layer formed by the union of circular fibres from the oviduct with the anterior rings of the retractors, and an internal longitudinal layer formed by the crossing anteriorly of the inner longitudinal fibres of the oviducts.

4. In the lower part of the body, the greater part of the walls is formed by muscular bands from the round ligament.

5. In the internal and external portion of the cervix longitudinal fibres, which are the continuation of the corresponding layers of the corpus, anteriorly and posteriorly pass in the median line. Beside this, the posterior wall of the cervix essentially consists of eccentric rings of the retractors, the interlacing fibres of which form other parts, and finally, externally of fasciculi from the ovarian ligaments, which after passing longitudinally are inflected.

In the anterior wall of the cervix only muscular lamellæ, running diagonally toward the mucous membrane, and covering each other like the tiles of a roof, can be recognized; the fibres of the retractors are found more especially in the lower third, forming a compact muscular mass from interlacing with the radiating fibres from the round ligament.

Bayer remarks that if these manifold convolutions of the muscular

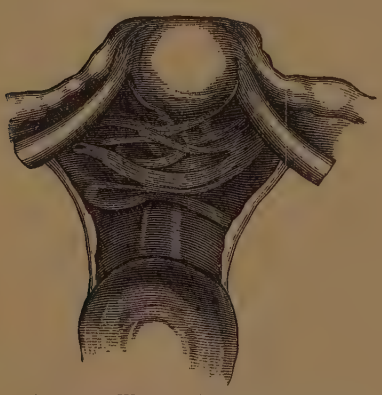
fibres make the picture of the uterus a very complicated one, the vessels which pass in every direction and render the preparation of the muscular layers exceedingly difficult, render it still more complex. The most vascular portions are the posterior and lateral walls of the corpus and the entire posterior wall and the anterior lip of the cervix.

Fig. 32 represents the internal surface of the uterus exposed by an incision through the middle of the anterior wall. The uterine portion of each oviduct is seen, surrounded by a system of circular fibres which pass anteriorly and posteriorly into a median strip of longitudinal fibres. The lower portions of the sides are covered with horizontally arranged circular segments which project sharply above the level of the surface, and turn slightly upward as they approach the median line above mentioned. Careful examination shows that the posterior longitudinal fibres pass outward, and the lateral fibres, after passing toward the horn of the uterus above the opening of the oviduct, curve around it and pass into it at the lower margin. The anterior median line of fibres, however, arches under the orifice of the oviduct, and these fibres disappear in the posterior and upper margin. The middle or central fasciculi pass directly over the fundus, in vertical arches, to the posterior wall. The circular systems around the orifices of the oviducts, therefore, appear to be composed of two spiral systems

Fig. 32.

Internal Surface of the Uterus; as shown after incision in the median line of the anterior wall.

Fig. 33.



Anterior Wall of Infantile Uterus.

Fig. 34.

Posterior Wall of Infantile Uterus.

which wind around from the interior of the oviduct toward the anterior and posterior walls of the corpus.

These fibres describe only a semicircle about the orifice of the

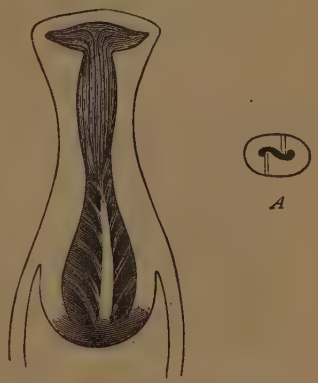
oviducts, and it is by the union of the two systems that complete circles are formed.

Fig. 33 represents an anterior view of the infantile uterus. Transverse fasciculi, issuing from the round ligament, and others from the broad ligament extend over the anterior surface of the uterus nearly as low as the peritoneal attachment. They cross in the median line, from which their longitudinal fibres pass over the fundus and also into the vesico-uterine folds. Frequently this median crossing presents the appearance of a raphé, which is continued without interruption in the direction of the external layer of the fundus.

Fig. 34 shows a very distinct raphé on the posterior wall of the same uterus. This is constantly present in the undeveloped uterus. From the point of union of the retractors, which are inserted under the internal os, a sharp, prominent ridge passes upward in the direction of the median line, and gives off transverse branches on each side. At the level of the insertion of the ovarian ligaments this ridge divides into two branches which pass horizontally and then turn downward toward the ligament. These lines taken together may be represented by the capital **T**. The uterus here represented shows an anomaly in this, that the retractors were at different levels, the right being shorter and placed higher up.

Fig. 35 represents the internal surface of the posterior wall of the same uterus; the mucous membrane has been scraped off. The cavity of the body is low and broad, and suggests the mode of development. A small isthmus, marked above by the projection of the wall, is continuous with the body, and furnishes the communication with the wider cavity of the cervix; the characteristic radiations of the arbor vitæ are seen in the cervical canal. The trunk of the arbor vitæ is toward the left side on the posterior wall, but upon the anterior wall toward the right side, and by this arrangement there is more accurate fitting together as of two dentated parts; a transverse section of the cervix presents the well-known **S**-form. Several arch-shaped fasciculi pass from the upper angles toward the median line, their course corresponding with similar muscular fibres lying beneath them.

FIG. 35.

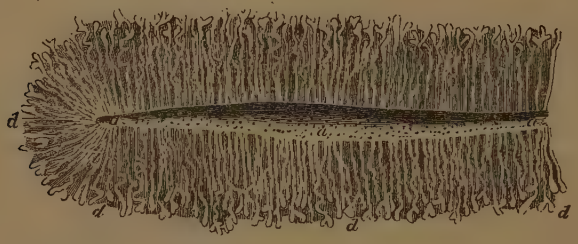


INTERNAL SURFACE OF POSTERIOR WALL OF UTERUS, after removal of mucous membrane.—*A*. Transverse section of cervix.

The Mucous Membrane of the Uterus.—The mucous membrane of the body differs from that of the neck, and will be first described. It is a pale pink in life, but becomes a grayish color after death, and is moist from its abundant glandular secretion. It has a thickness of .039 to .078 inch, two to four millimetres, in the virgin uterus, .23 to .31 of an inch, six to eight millimetres, in the parous uterus; it is thinner in the vicinity of the entrance of the oviducts than elsewhere. It becomes greatly swelled

during menstruation, so that its thickness is two or three times greater. Its free surface is smooth, and upon it the mouths of the uterine glands open; these glands are so numerous that their openings occupy nearly one-third of the entire surface.

FIG. 36.

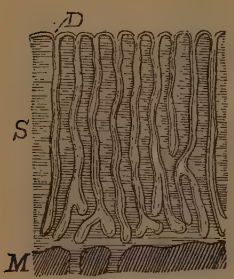


GLANDS OF THE BODY OF THE UTERUS.—*a a*, free mucous surface of the uterus, with mouths of glands opening in it. *d d*, glands.

The adherent surface of the mucous membrane is so intimately attached to the muscular tissue that it is impossible to separate them; there is, according to Cadiat, an actual reciprocal penetration.[1] A single layer of cylindrical ciliated epithelium is found upon the free surface; the movements of the cilia is from the mouth of the uterus towards the oviducts. Beneath this there is found amorphous matter containing a large number of fibro-plastic bodies.

Utricular Glands.—These glands are cylindrical and flexuous. Englemann states that they are often bifurcated at their lower third, but according to De Sinéty they are rarely bifurcated, and Sappey describes them as generally single, sometimes bifid, or trifid. They are lined with ciliated epithelium, and secrete a transparent, alkaline, fluent mucus.

FIG. 37.



VERTICAL SECTION OF THE MUCOUS MEMBRANE OF THE VIRGIN. —*W.* Uterus, magnified forty diameters. *S.* Mucous membrane. *D.* Uterine glands. *M.* Muscular stratum.

Mucous Membrane of the Neck.—This is whiter, thinner, and of firmer consistence than is that of the body. Cylindrical epithelium with vibratile cilia is found in the upper two-thirds, but in the lower third pavement epithelium. The borders of the elevations caused by the *arbor vitæ* are lined by ciliated epithelium. But in passing from the free borders of, to the sides of the elevations referred to, the ciliated is replaced by cup-shaped epithelium which becomes more and more developed as it penetrates more profoundly into the numerous glands situated at the fundus of a mucous fold.[2] The glands, which are so abundant in the cervix that Spiegelberg calls it a great gland apparatus, are not tubular, like those of the corpus, but racemose. These glands secrete a thick, viscid alkaline, gelatin-like mucus; it forms the gelatinous plug that frequently in

[1] Schwartz.

[2] De Sinéty.

pregnancy is found filling the cervical canal. No glands are found at the level of the external mouth of the womb. Obstruction of the excretory duct of one of the cervical glands gives rise to a retention by the accumulation of secretion; and such cysts are known as the ovula Nabothi, because of Naboth's error in regarding them as human eggs.

FIG. 38.

EPITHELIUM WITH VIBRATILE CILIA. (350 diameters.)—*a*. Nucleus. *b*. Nucleolus. *c*. Body of the cell. *v*. Vibratile cilia.

FIG. 39.

EPITHELIUM WITH CUP-SHAPED CELLS. (350 diameters.)—*a*. Nucleus. *b*. Nucleolus. *c*. Body of the cell forming a cavity.

Beneath the epithelium there are fibrous[1] laminæ which are continuous with those interposed between the muscular fasciculi, and hence the intimate union between the mucous membrane and the subjacent tissue.

Bloodvessels of the Uterus.—The four chief trunks supplying blood to the uterus are the two uterine and the two ovarian arteries. The two latter, which correspond to the spermatic in the male, not only carry blood to the uterus but also to the ovaries and to the oviducts. In addition to the arteries mentioned, a branch from the epigastric, on each side, passes through the round ligament to the uterus. On account of the number and volume of the arterial currents supplying the uterus, this organ has been compared to the brain. The uterine arteries are given off by the internal iliacs, while the ovarian proceed directly from the aorta just below the renal. The uterine artery, pursuing a remarkably flexuous course, enters the base of the broad ligament, and at the middle of the cervix gives off two branches, one of which passes in front of, the other behind the cervix, to unite with corresponding branches derived from the other uterine artery, thus making a complete anastomosis, and at the same time forming an arterial ring which encircles this portion of the uterus. The chief trunk ascends, and at the level of the fundus gives off a large number of branches,[2] which enter beneath the peritoneum into the muscular tissue to pass to the mucous, becoming capillaries in the muscles, and forming a fine network around the glandular cul-de-sacs. The uterine artery anastomoses with the ovarian, forming a large arch. The ovarian is chiefly distributed to the fundus and the upper part of the body of the uterus. Both the uterine and the ovarian arteries are remarkable for their serpentine course or corkscrew form.

Uterine veins, which anastomose with each other, collect the blood from mucous and muscular capillaries. They are generally large, but in pregnancy are so increased in size that they are called sinuses; their walls are firmly fastened to the muscular framework of the uterus by strong connective tissue, and thus "thousands of living ligatures" are

[1] Schwartz. [2] Ibid.

provided for the arrest of hemorrhage after detachment of the placenta; the construction of the middle muscular coat of the uterus with the relation of the veins which traverse it seems to have been especially designed for this purpose. Emerging from the uterus at its sides, the veins freely anastomose so that a large plexus is formed on each side, inclosed in the folds of the broad ligament known as the utero-ovarian plexus; this plexus is dilated in menstruation, and in all other cases of uterine congestion. Four veins, two uterine and two ovarian, carry the blood from these plexuses; the uterine empty into the internal iliac veins, the left ovarian into the left renal, and the right ovarian directly into the vena cava. Veins also pass through the round ligaments, and empty into the epigastrics or into the external iliacs.

FIG. 40.

POSTERIOR VIEW OF MUSCULAR AND VASCULAR ARRANGEMENTS.—Vessels. 1, 2, 3. Vaginal, cervical, and uterine plexuses. 4. Arteries of body of uterus. 5. Arteries supplying ovary muscular fasciculi. 6, 7. Fibres attached to vagina, to the pubic, and to the sacro-iliac joint. 8. Muscular fasciculi from uterus and broad ligaments. 9, 10, 11, 12. Fasciculi attached to ovary and oviduct. (After Rouget.)

The erectility of the uterus is claimed to result from the disposition of its arteries and veins. Rouget showed that when its veins were injected it became erect, swollen, its size greater, and its cavity increased by the separation of its walls. This erection is by some supposed to occur during coition, and to facilitate the entrance of spermatozoids into the uterine cavity.

The Lymphatics of the Uterus.—These have been divided into three sets or systems, viz., a subserous, a muscular, and a mucous. The last has no vessels, but is composed of numerous and large lymph spaces, so that the mucous membrane has been called an enormous lymph gland; these spaces freely communicate with each other; they are formed by trabeculæ lined with endothelium, and encircle the vessels and glandular cul-de-sacs; they communicate with the lymphatic vessels of the muscular wall.

The lymphatic system of the muscular coat is arranged in three planes, internal, middle, and external. The first is composed of cylindrical vessels running transversely, placed between the muscular fasciculi, and uniting the submucous lymph set with the middle muscular plane. The second plane is composed of vessels provided with valves, and which are tortuous; these convey the lymph to the vessels of the broad ligaments. The third, or superficial muscular plane, consists of vessels placed longitudinally between the muscular fasciculi; they furnish communication between the large trunks of the middle layer and the subperitoneal lymphatics. The subperitoneal lymphatics are found upon the anterior and upon the posterior face of the uterus, and at its sides. Those of the neck form a large subperitoneal plexus, and then unite in vessels which communicate with the lateral and sacral ganglia. According to Champonnière a ganglion is found on each side of the uterus at the isthmus, and this fact is regarded as of importance in connection with the development of certain puerperal diseases. The subperitoneal lymphatics of the body of the uterus are large vessels provided with valves; those at the sides directly enter the lymphatic vessels of the broad ligaments, and those upon the anterior and posterior face indirectly through the vessels of the middle muscular plane.

The Nerves of the Uterus.—The *plexus uterinus magnus*,[1] formed by branches from the superior mesenteric plexus, and from the spermatic ganglia, which receive large branches on both sides from the fourth sympathetic ganglion, is situated at the bifurcation of the abdominal aorta. An inch and a half, 3.79 centimetres, below the bifurcation, directly at the promontory, this plexus divides into two branches, which pass right and left about the rectum, and go to the upper part of the vagina and the uterus; these two branches are the hypogastric plexuses. They receive numerous filaments from the fifth lumbar ganglion, and from the first, second, and third sacral ganglia of the sympathetic. When they have reached the side of the rectum, the hypogastric nerves divide into two unequal branches. The smaller of these remains at the inner side of the pelvic vessels, and is distributed to the posterior and lateral parts of the uterus. The larger branch goes under the vessels, and passes partly to the large cervical ganglion, and in part unites with the sacral nerves. The cervical ganglion in pregnancy is nearly two inches long, 5 centimetres, and an inch and a half broad, 3.79 centimetres; it is situated at the side of the posterior vaginal vault, and is formed from both hypogastric

[1] Kleinwächter.

plexuses, from the three first sacral ganglia, and from the second, third, and fourth sacral nerves. It supplies the entire uterus, and especially the cervix, with nerves.

The mode of termination of the nerve fibres in the mucous membrane is unknown; in the muscular tissue this termination is, according to Frankenhauser, in the nuclei of the muscle cells. No ganglia are found in the intra-muscular nerve plexuses of the uterus, and in this regard there is a remarkable contrast between these plexuses and those of the stomach and intestines, which are very rich in ganglia. Physiological experiment has proved the presence of vaso-dilating and vaso-constricting nerves in the uterus. Kleinwächter remarks that a knowledge of the nerve distribution does not explain the way by which uterine contractions are produced.

Interesting investigations have been made to ascertain the nerve-centre presiding over uterine contractions, and, as remarked by Dembo,[1] there is not a point in the cerebro-spinal system where such a centre was not supposed to be found. According to some, the centre was in the cerebellum; according to others, in the bulb; and still others have found it in both; some place it in the lumbar region of the spinal cord, others at the tenth dorsal vertebra, and others make all points of the spinal cord capable of causing uterine contractions. Some have placed the centre in the great sympathetic, though differing as to the part. Finally, some hold that the uterus has its own independent centres. Among the most recent investigations are those made by the author just quoted, and his conclusion is that most probably the centres governing uterine contractions are situated beneath the peritoneum, above the anterior wall of the vagina; he has found there numerous ganglionic groups of different sizes, some of them with a hundred cells or more.

Position of the Uterus and Means by which the Organ is sustained.— The general place in the pelvic cavity which the uterus occupies, and the relations of the latter to the bladder and the rectum have been mentioned on page 56. The situation of the uterus is not a fixed one, but there is a great normal mobility provided for, so that the organ may change its position according to certain physiological functions, and according to the condition of the neighboring organs. Thus during respiration there are alternate descent and ascent of the uterus; the position varies as to the state of the rectum and of the bladder; it is not the same when the subject is standing or lying down; it varies in the nulliparous and parous, and when at rest, or in the exercise of its physiological functions. The most remarkable change of position from physiological cause is that which occurs in pregnancy, when from having been a pelvic, the uterus becomes almost entirely an abdominal organ; yet after pregnancy is over, and subsequent involution completed, it occupies nearly its original position.

Figs. 41 and 42, from Schultze, show the position of the uterus in the virgin, and in the child-bearing woman, when the bladder is empty.

In most instances the uterus is not entirely in the transverse diameter of the pelvis, but a slight rotation occurs by which the left side is

[1] Annales de Gynécologie, Fev. 1883.

thrown toward the front, and the right backward. This rotation, which becomes very marked in most women during pregnancy, is simply the expression of an embryonic condition which will be referred to hereafter.

FIG. 41.

NORMAL SITUATION OF THE VIRGIN UTERUS WHEN THE BLADDER IS EMPTY.

FIG. 42.

POSITION OF UTERUS IN A WOMAN WHO HAS BORNE A CHILD.

Fig. 43, from Ramsbotham, shows the position and relations of the uterus as seen from above. The uterus is kept in its normal position by its connection with the vagina, with the bladder, and with the pelvic fascia, and by certain ligaments which will now be described.

The Uterine Ligaments.—These are six in number, three belonging to each half of the uterus as made by the antero-posterior division. They are known as the round, the broad, and the utero-sacral, and each is formed by a fold of peritoneum including between the two sides muscular and connective tissue, vessels, and nerves.

The Round Ligaments.—The round ligaments are two cords covered by peritoneum, passing from the uterus at a point a little below the origin of the oviducts, and at the junction of the anterior face with the lateral border of the uterus, to the inguinal canal, where their peritoneal investment ceases, and they somewhat change their form; each ligament is continued through the inguinal canal, and ends by an expansion of its fibres in the upper part of the labia majus. The ligament has not only unstriped, but also striped muscular fibres; the latter originate

from the lower part of the inguinal canal and from the pubic spine, and are continued toward the uterus, but end at the level of the pelvic inlet. The round ligament has a notable amount of connective and elastic tissue, and contains an artery, which, originating from the epi-

FIG. 43.

UTERUS WITH ADJACENT ORGAN AS SEEN FROM ABOVE.—*a*. Mons veneris. *b*. Bladder. *c*. Fundus of the uterus. *d*. The rectum. *e, e*. The oviducts. *g, g*. The ovaries. *h, h*. Posterior processes of broad ligaments. *i, i*. Round ligaments. *k*. Cœcum with its appendages. *l*. Small intestine. *m*. Body of one of the lumbar vertebræ.

gastric, passes on toward the uterus, and anastomoses with the uterine artery, thus making a connection between the general circulation and that of the uterus. Up to the eighth month of fœtal life the peritoneum is continued into the inguinal canal, making the canal of Nuck, when it is usually closed; should it remain open, an effusion into this peritoneal prolongation may occur, and the disease is known as hydrocele of the female. In the non-pregnant condition the round ligaments play an important part in preventing retroversion or retroflexion of the uterus. During pregnancy they are notably increased in size, but unequally, and it has recently been stated[1] that by examining them

[1] Homburger. Gynäkologische Klinik herausgegeben von Dr. Wilhelm Alexander Freund. Erster Band. 1885.

through the abdominal wall, and appreciating their development, a correct prognosis can be given as to the activity of the labor-pains, for that development is a guide to the muscular development of the uterus. During labor the contraction of the round ligament draws the upper part of the uterus forward, securing economy of force by the direction given it during uterine contractions.

The Broad Ligaments.—These extend from the sides of the uterus to the sacro-iliac joints. They are separated from each other by the intervening uterus, but the anterior layer of the one side is continuous with that of the other, passing over the anterior face of the uterus; in like manner the posterior layers are continuous. Thus the pelvic cavity by means of these ligaments and the uterus is divided transversely into two unequal parts, the anterior being known as the vesical, the posterior as the rectal. The superior border of the broad ligament presents three peritoneal folds, known as wings—an anterior, a middle, and a posterior wing; the first includes the round ligament, the second the oviduct, and the third the ovarian ligament, which is attached to the inferior border of the ovary. At the sides of the pelvis the peritoneal layers of the broad ligament separate, being continuous with that lining the pelvis; below, a separation also occurs, the posterior fold to be reflected over the rectum, the anterior over the bladder. At the internal border of the ligament, the two peritoneal folds separate to receive the uterus. Large veins and lymphatics pass from the uterus at this border. The broad ligaments contain between the peritoneal folds connective tissue, vessels, and nerves, and muscular fibres; the adherence of the serous membrane to the muscular tissue is so intimate, that the former cannot be separated without at the same time removing part of the muscular layer.

The broad ligaments beside assisting in the suspension of the uterus, prevent its lateral deviations, and aid in restoring it to its normal position after partial retroversion caused by a distended bladder. During pregnancy the peritoneal folds separate so completely to accommodate the enlarging uterus, that at the end of gestation the broad ligaments have almost completely disappeared.

The Parovarium, or Body of Rosenmüller.—If that portion of the recently removed broad ligament including the oviduct and the ovary, be held up to the light, there will be seen a series of fine tubes passing to the hilum of the ovary, and each terminating in a cul-de-sac; above these, tubules communicate with a canal perpendicular to them and parallel to the oviduct. The number of tubes is said to be from fifteen to eighteen, but Doran[1] mentions finding in one specimen twenty-four. The body thus described is called the parovarium, or body of Rosenmüller; it is the vestige of an embryonic structure known as the body of Wolff. The efferent duct continues patent in some of the domestic animals, and is called the canal of Gärtner. The two urethral ducts, described by Skene, have been by some thought to be the inferior portion of the efferent ducts of the parovarium.

The Utero-Sacral Ligaments.—These are two semi-lunar folds pass-

[1] Tumors of the Ovaries, etc.

ing from the uterus posteriorly just above the union of the vagina, and attached to the third and fourth sacral vertebræ immediately within the lower part of the sacro-iliac joint. They form by their superior lateral borders a narrowed passage, or mouth of Douglas's cul-de-sac, or the retro-uterine peritoneal pouch, and in some cases, where the retroverted uterus has sunk into this pouch, may hinder its restoration. These ligaments contain muscular tissue, and are hypertrophied in pregnancy. According to Luschka a part of the muscular fibres of each side unite behind the cervix, making a half ring, and the muscle formed by this union is called the muscle of Luschka, or according to the function assigned it by him, the retractor of the uterus. Schultze regards it as the elevator rather than the retractor of the uterus, while the general action of the folds is that of a suspensory ligament of the uterus.

The utero-sacral ligaments are elongated in pregnancy. Vesico-uterine ligaments are also described by some; however, little importance is attached to them as means for keeping the uterus in normal position.

The Ovaries.—These organs, of equal importance with the testicles of the male for reproduction, were called by Galen *testes muliebres.* They are sometimes classed as glandular organs, their supposed function being to secrete ovules; but as the ovule has to a certain degree its existence before the ovary, the latter serves as a place of deposit, of preservation and completion for the primordial ovules, and does not secrete, but contributes to the evolution of these essential anatomical elements of the organ, and for which it is made.

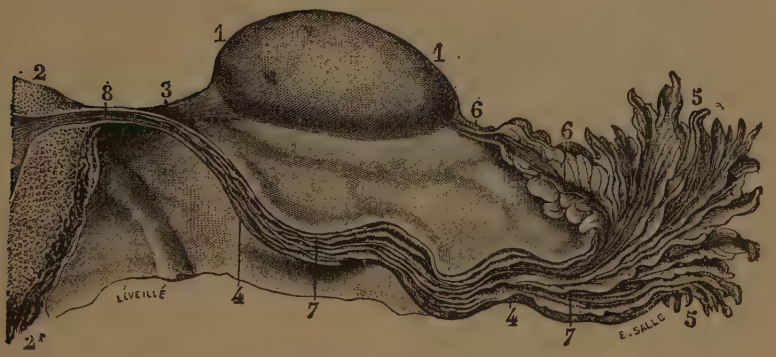
Number, Position, and Attachments of the Ovaries.—The ovaries in the human female, as in almost all vertebrates, are two; in birds,[1] however, but a single ovary, usually the left, is found, the other having atrophied, this atrophy beginning about the seventh day of incubation. These organs are in the pelvic cavity, one on each side of the uterus; their long diameter[2] is not transverse, as is usually represented, but parallel to the lateral pelvic walls, and almost at the level of the plane of the inlet; their lateral attachment to the pelvis is higher than their attachment to the uterus; their superior border is at the plane of the inlet, and below the internal border of the psoas and iliac muscles. According to Schultze the contraction of the belly of the combined psoas and iliacus muscles is the best guide for the external hand in bimanual palpation of the ovaries; and Charcot states that the ovarian pain of the hysterical corresponds most frequently with the point of intersection of two lines, the one drawn between the superior anterior iliac spines, and the other making the prolonged lateral boundary of the epigastrium.

The ovaries are placed in the posterior wing of the broad ligaments; they are behind the oviducts, and in front of the rectum, being usually separated from the latter by coils of intestine. By their relation with the broad ligaments they are attached externally to the pelvic walls. Other attachments are by the utero-ovarian, the tubo-ovarian, and the

[1] Duval. [2] Schultze.

posterior round ligaments. The utero-ovarian ligament, by some called the ovarian ligament, is a cord composed of smooth muscular fibres; these fibres may be followed into the posterior wall of the uterus, and traced down as far as the internal os; it passes from the superior angle

FIG. 44.



THE OVARY AND OVIDUCT. (The latter opened longitudinally.)—1, 1. Ovary. 2. Part of the uterus. 3. Ovarian ligament. 4, 4. Oviduct, its walls opened by a longitudinal incision to show the longitudinal folds of its lining membrane. 5, 5. Pavilion from internal surface. 6, 6. Fimbria attached to the ovary, or tubo-ovarian ligament. 7, 7. Longitudinal folds. 8. Internal end of the oviduct.

of the uterus on each side, to the internal end of the ovary. This ligament is about one inch and a quarter, 3.16 centimetres, in length. The tubo-ovarian ligament is formed by the attachment of one of the fringed processes of the pavilion of the oviduct to the external end of the ovary. It is probable that the superior surface of this ligament bears an important part in the transfer of the ovule from the ovary to the oviduct. The middle fibres of the posterior round or lumbar ligament pass to the ovary. This ligament, according to Rouget, is formed of a lamella of smooth muscular fibres which originate from the sub-peritoneal fascia, passing from behind forward to be distributed, the internal upon the body of the uterus, the external to the pavilion, and the middle to the hilum of the ovary.

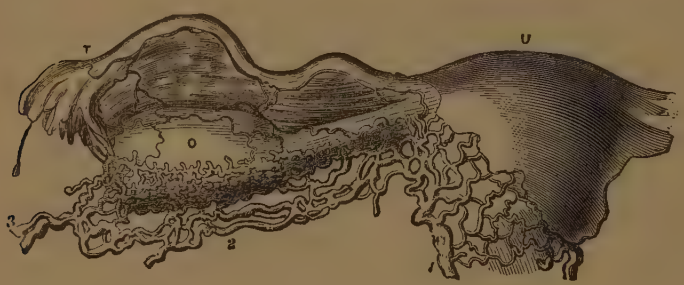
The ovary has considerable mobility, and hence the possibility of both physiological and pathological changes of position, the most remarkable of the former being that which occurs in pregnancy, for the ovaries ascend with the uterus into the abdominal cavity, and afterward descend with it into the pelvis.

Form, Size, and Aspect of the Ovaries.—The ovary is usually an ovoid, somewhat flattened antero-posteriorly; its superior border is convex, and its inferior plane; its ends, or extremities, give attachment to the ligaments already mentioned. Except these attachments, and that of the inferior border to the peritoneum, the organ is free. The size of the ovaries varies in individuals at different ages, and as to the condition of ovulation; it is greater during menstruation and during pregnancy than at other times; the right ovary is usually somewhat larger than the left. The average dimensions of the organ are, in length 1.4 inches, 38 millimetres, in vertical measurement 0.7 of an

inch, 18 millimetres, and antero-posteriorly half an inch, or 15 millimetres. The weight of the ovary is from 90 to 120 grains, or 6 to 8 grams. The surface of the ovary is white and smooth at the beginning of menstrual life; it becomes uneven and irregular from the cicatrices of ruptured ovisacs, these being more numerous as age advances, and the color changes to a yellowish-brown.

The Hilum and Bulb of the Ovary.—Between the two layers of peritoneum which are attached to the inferior border of the ovary, the ovarian vessels and nerves pass. The arteries, eight or ten in number, derived from the anastomosing arch of the uterine and ovarian, have a helicine form before entering the hilum of the ovary; upon this layer of arterial vessels there is placed, in front and behind, a much thicker layer of venous vessels; an injected specimen shows a large mass of bloodvessels, chiefly venous, which communicate with the pampiniform plexus and with the uterine plexus. This is the bulb or spongy body of the ovary; it should not be confounded with the bulbous portion of the ovary, which will hereafter be described.

FIG. 45.

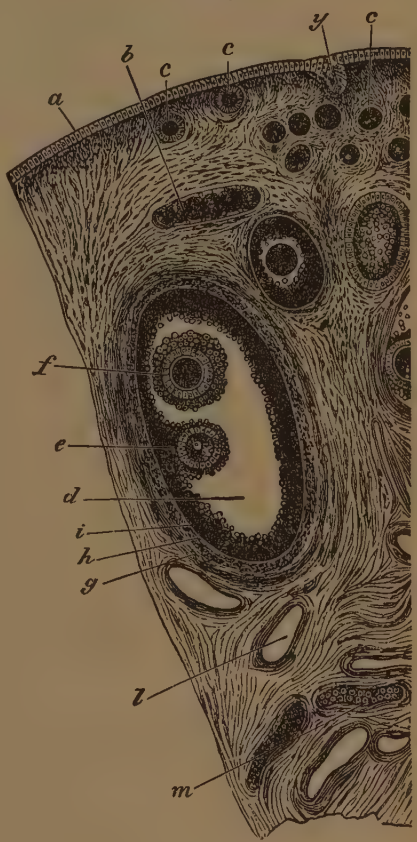


BULB OF OVARY.

Structure of the Ovary.—It was once generally held that the ovary was covered by peritoneum, and had a tunica albuginea, but neither statement is now regarded as true. The researches of Waldeyer have shown that the peritoneum ceases at the inferior border of the organ, and that all the rest of its surface is covered with a simple layer of flattened cylindrical epithelium; this covering presents a dull-white appearance, which is in striking contrast with the bright, almost shining, appearance of the peritoneum; at the inferior border of the ovary there can be seen a finely-notched line, marking the place where the latter ceases and the former begins. The supposed tunica albuginea has been proved to be, instead of a mere covering, the essential part of the organ. A vertical section of the ovary shows that it is composed of two very different substances. The superficial, or cortical portion, is white, firm, and apparently homogeneous; the internal, or medullary portion is reddish, spongy, and not homogeneous; it constitutes seven-eighths of the organ. The ovisacs are found only in the superficial layer, and it is therefore called by Sappey the glandular or ovigenous portion; while the central part, the great mass of the organ, is called the bulbous portion; by some it is also called the medullary portion.

The peripheral, or ovigenous layer is the essential part of the ovary; it is composed of an external layer of epithelium, which represents the germinative epithelium of the pleuro-peritoneal cavity of embryonic life, of a fibrous framework, the fibres crossing each other, the superficial portion more dense than that beneath it, yet no line of separation between the two; in the meshes of this tissue the ovisacs are found. Only fifteen or twenty ovisacs can be discovered by the unaided eye, but the microscope reveals an almost infinite number. Sappey's investigations have authorized him to state that in each ovary of a girl, eighteen to twenty years of age, there are more than three hundred thousand, making some seven hundred thousand for the two; in one instance, that of a girl four years old, the number was one million, one hundred and fifty thousand. Nature is prodigal in supplying means for the continuance of the race. The bulbous portion is composed of vessels, nerves, muscular and connective-tissue fibres; it furnishes nutritive material to the ovisacs and ovules, and also a surface upon which the ovisacs may be distributed, so as to facilitate their growth and rupture, and the reception of the escaping ovules by the oviduct.

FIG. 46.



FROM AN OVARIUM OF AN OLD BITCH. High Power. —*a*. Germinal epithelium. *b*. Ovarian tubes. *c*. Younger follicles. *d*. Older follicles. *e*. Proligerous disk, with egg. *f*. Epithelium of second egg in the same follicle. *g*. Tunica fibrosa folliculi. *h*. Tunica propria folliculi. *i*. Epithelium of the follicle (membrana granulosa). *l*. Vessels. *m*. Cell tubes of the parovarium in long section. *y*. Tubiform depression of the germinal epithelium into the ovarian tissue. (Stricker.)

Vessels and Nerves of the Ovary.—The arterial supply of the organ, as well as the helicine course of the arteries before entering the hilum have been mentioned. These vessels after penetrating the ovary still preserve the helicine form; they are distributed to the bulbous portion, and fine ramifications pass to the ovigenous layer, but hardly go to the most external layer; but the ovisacs that have reached notable development have vessels passing to their walls. The veins are remarkable for their size, varicose appearance, and numerous anastomoses; after contributing to the formation of the

bulb to the ovary, the blood passes from the bulb on either side into the ovarian veins. The nerves are from the ovarian plexus. Their final distribution is not known; Duval suggests that they are especially designed for the vessels and the unstriped muscular tissue of the bulbous portion; Luschka has seen an axis cylinder enter the wall of an ovisac. Large lymphatic vessels emerge at the hilum, and pass to the lumbar ganglia. It has been shown that the tissue about an ovisac is rich in lymph supply, so that De Sinéty remarks that the follicle is plunged into a closed lymph sac, a condition which appears very favorable for nutrition.

The Ovisacs.—These were discovered by De Graaf, in 1672, and are frequently called the Graafian vesicles, or follicles; but a designation which points to their most important office, containers of ova, and therefore ovisacs, seems more appropriate.

An ovisac consists of a capsule, and within the capsule the membrana granulosa, the liquid of the ovisac, and the ovum. The capsule is described by some as composed of two layers, an external called the tunica fibrosa, and an internal called the tunica propria. But as it is impossible to separate the supposed external one from the surrounding ovarian tissue, "from which it does not differ except from its fibres being looser, and the greater predominance of cell elements," most authorities consider the capsule as having but a single wall. This is a thin, transparent, vascular membrane, composed, according to Robin, of fibrous laminæ pressed against each other, transparent amorphous matter with fine granulations, and large polyhedric cells with rounded angles, which are not found elsewhere, except in the uterine mucous membrane developed by pregnancy. The liquid of the ovisac, liquor folliculi, is clear, viscid, alkaline, and contains oil globules and granulations.

Upon the inner surface of the capsule a layer of round nucleated cells is found, constituting the membrana granulosa. An accumulation of these cells occurs at some part of the ovisac, forming the discus proligerus, and in this mass the ovum is found. The discus proligerus is not usually at the most projecting part of the ovisac, but at its lowest. The ovum, or ovule, discovered in 1827, is spherical, and about $\frac{1}{120}$ of an inch in diameter. It is composed of three parts, an investing membrane, the vitelline membrane, a granular liquid, known as the vitellus, a transparent vesicle, the germinal vesicle, and, finally, the germinal spot. The germinal vesicle, or nucleus of the ovule, is $\frac{1}{700}$ of an inch in diameter, and the germinal spot, or nucleolus, is $\frac{1}{3000}$ of an inch in diameter.

The Oviducts.[1]—These are canals or tubes, placed one on each side of the uterus, through which the spermatozoids pass to or near to the ovaries, and by which the ovule is transmitted to the uterus. In rela-

[1] Commonly called Fallopian tubes. Fallopius, a famous anatomist of the sixteenth century, the successor of Vesalius in the University of Padua, describing the oviduct compared it to *tuba*, a trumpet, not a tube, or canal; and his name has been given the organ. But the oviducts were described long before the time of Vesalius by Erophilus and then by Rufus of Ephesus. It seems, therefore, that it would be better to have the names of these organs determined by their most important function, that of excretory ducts for the ovaries, than to perpetuate one which is doubly misleading.

tion to the ovaries, they are its excretory ducts. They are in the upper border of the middle fold of the broad ligaments. An oviduct is between four and five inches, ten to twelve centimetres, long; its diameter increases from the uterus to the ovary; this is, according to Sappey, near the uterus, 0.15 of an inch, or four millimetres; at its middle portion, 0.19 to 0.22 of an inch, or five to six millimetres; and at the abdominal opening, 0.27 to 0.31 of an inch, or seven to eight millimetres. At the abdominal end there is an expanded portion, having a diameter of about seven-tenths to eight-tenths of an inch, 18 to 20 millimetres, called the pavilion or ampulla. The external surface of the pavilion is covered by peritoneum continuous with that of the body of the oviduct; its internal surface is concave, and covered with ciliated mucous membrane; its margin, where continuous with that lining the oviduct, meets serous tissue, is not uniform and regular, but divided by numerous fissures, so that it presents a fringed appearance, and the projections thus formed are called fimbriæ. Some of the fimbriæ are rounded at their free end, others elongated and irrregular; one of them is without free extremity, but is attached to the ovary, making the tubo-ovarian ligament; and hence the pavilion necessarily follows the ovary in its physiological or pathological changes of position; the tubo-ovarian ligament presents upon its upper surface a groove or canal leading directly to the oviduct. The number and delicacy of the fimbriæ can be well seen by taking a fresh specimen of the oviduct, and gently moving the abdominal end to and fro in clear water. From the opening into the oviduct a number of folds, continuous with similar formations in the body of the organ, radiate to the circumference of the pavilion.

An accessory pavilion is found, according to Sappey, once in sixty subjects; once in sixteen according to Richard. In some instances two have been observed, and once three. They have the same form as the normal one, and communicate with the oviduct; it is possible that the ovule may enter one of these from the oviduct, and thence pass into the abdominal cavity. The internal or uterine orifice of the oviduct is only one-twenty-sixth of an inch, or one millimetre in diameter. The oviduct is formed of three coats, an external peritoneal, a middle muscular, and an internal mucous. The peritoneal coat extends from the uterus over the entire length of the organ, but of course fails at the lower portion corresponding with the interval between the folds of the broad ligament. The muscular coat consists of a layer of longitudinal fibres, and beneath it one of circular fibres; both of these are continued into the muscular walls of the uterus. The mucous membrane is thrown in folds which are closely applied to each other, so that there may result a capillary attraction, similar to that observed when two pieces of glass are pressed together, and then partly immersed in water. The mucous membrane is lined with ciliated epithelium, the movement of the cilia being from the ovary to the uterus; this condition is supposed to be a factor in the transmission of the ovule to the uterus.

The oviducts have the same source of blood and nerve supply as the ovaries. The lymphatics unite with those of the uterus and of the ovary.

Development and some of the Anomalies of the Female Generative Organs.—While naturally belonging to the subject of Embryology, it is thought suitable to give in connection with the anatomy of the female organs of generation a brief sketch of their development, and present some of the anomalies of obstetric interest and importance that may occur in that development.

Development of the External Organs of Generation.—The formation of these organs begins in the fourth week of embryonic life. At that time[1] there is at the posterior extremity of the body a simple opening, representing the orifice common to the intestine and the allantois, the future bladder, into which the Wolffian canals will also empty, and which is the orifice of the cloaca—the inferior portion of the intestine after the development of the allantois being called the cloaca. Before this single opening is divided into two, anal and uro-genital, there appears in front of the orifice an elevation, called the genital swelling or tubercle then two lateral folds, the genital folds. At the end of the second month this swelling is greater, and there is seen at its lower part a cleft or fissure, extending to the opening of the cloaca, the genital furrow. About the middle of the third month the cloacal opening is divided so as to form two orifices; the most generally received explanation of this division is that it occurs by the formation of two lateral folds from the cloaca, and at the same time a projection from the point of union of the rectum and allantois descends; the lateral folds and the central process unite so as to form a complete wall, the inferior border of which becomes the perineum, and the wall divides the cloaca into two cavities, rectal and uro-genital.

The labia majora are developed from the lateral genital folds, and the labia minora from the borders of the genital fissure, while the clitoris is formed from the genital tubercle, or the upper part of the genital swelling. Into the uro-genital sinus the bladder developed from the allantois and the seminal ducts empty, and hence its name. This sinus is shortened by the descent of the vagina, and in the fourth month of embryonic life the urethra and vagina are distinct canals.

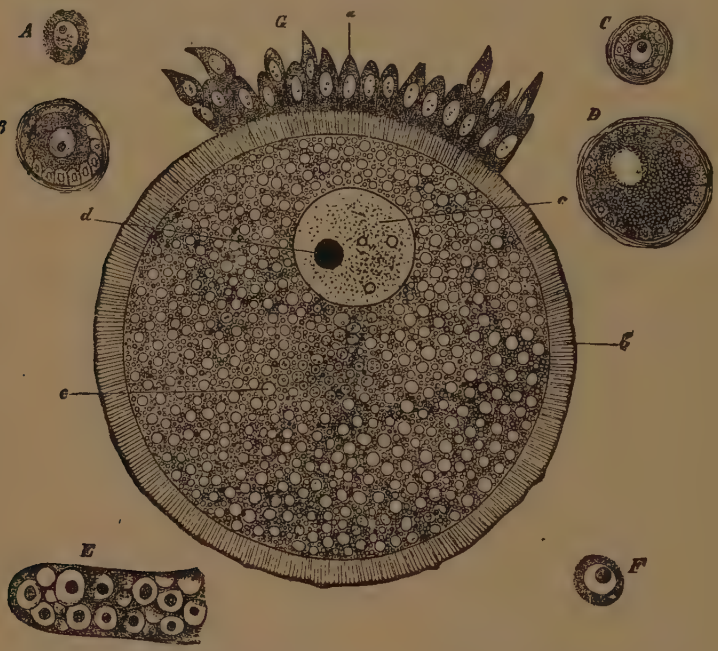
Development of the Internal Organs of Generation.—The internal genital, as well as the urinary apparatus, is developed from two transitory embryonic structures known as the Wolffian bodies. From the fact that these bodies temporarily exercise the function of the kidneys, they are known as primitive kidneys, false kidneys, primordial kidneys and kidneys of Oken. Their structure is analogous to that of the kidneys; they are composed of an excretory duct, which occupies a longitudinal position, and of fine tubes which are transverse and empty into this duct; these canaliculi are enlarged at their closed end, and in this enlargement a vascular glomerulus is found. The duct appears prior to the gland, according to the general law[2] in the formation of all glandular organs, that the excretory canal is first formed. In the second month of embryonic life the Wolffian body appears as an oblong mass situated on the side of the vertebral column, and extending from the chest to the pelvis. These bodies soon become atrophied,

[1] Kölliker. [2] Imbert, op. cit.

leaving as their chief vestige on each side the organ of Rosenmüller, or the parovarium which has been described in connection with the description of the broad ligaments. Before this atrophy occurs, there is a notable thickening of epithelium, called by Waldeyer germinative epithelium, composed of long cylindrical cells upon the inner and upon the outer surface of the Wolffian body; the former is the origin of Müller's duct, the latter of the ovary and the ovules. The formation of Müller's duct takes place, according to Waldeyer, by the appearance of a longitudinal fold of the germinative epithelium which is sunk in the connective tissue of the external lateral part of the Wolffian body; this fold is covered over, and thus converted into a tube. It remains open externally, and that portion becomes the pavilion. The occurrence of secondary pavilions, to be referred to in the description of the oviduct, is readily explained, according to Duval, by supposing that the canal of Müller is not completely closed in all its extent at the period of embryonic life when the two borders of the gutter, which give origin to it, are turned towards each other, in order to transform the gutter into a canal. Müller's ducts unite in a part of their course to form the uterus and the vagina; the limit to this union is the insertion of the round ligament, which is the analogue of the gubernaculum testis in the male, and has the same relations with the inguinal canal. All of the duct below the round ligament unites with the corresponding portion of the duct on the other side, thus making at first a double uterus and vagina; but absorption of the intervening wall occurs, and each organ is single. The left duct is usually farther in front than the right, and the two are united in this oblique position; the presence of the intestine upon the left side is thought to explain the fact that the left duct is placed farther to the front than the right. The fusion of the two ducts is complete in the embryo of two months. The point where this union begins is unsettled. Kölliker believes that it is at the middle of Müller's canals, while others hold that it takes place from below upward. All that portion of the duct above the insertion of the round ligament becomes the oviduct. The prominence on the internal face of the Wolffian body is composed of a mass of embryonic connective tissue covered by well developed germinative epithelium; it is the first rudiment of the genital gland, and is found alike in the embryo which is to be a male, as well as in that which is to be a female; in the female the ovaries and ovules are derived from the epithelial covering, while the outgrowth itself is destined to furnish the vascular stroma of the ovary. The next change that is observed is the appearance of cells, which are round, have a well-developed nucleus and distinct nucleolus; these are the primordial ovules or primitive ova. At the deep part of the genital eminence, and in close contact with it, sections show that the tubes of the upper portion of the Wolffian body are narrower, and have a clearer epithelium than those of the lower portion; the superior is known as the sexual or genital portion, the inferior as the urinary. If the genital prominence is to be developed into a testicle the germinative epithelium and the primordial ovules rapidly disappear; but if it is to be an ovary, the former becomes more developed, and the ovules increase in

number. The primordial ovules, in consequence of the growth of other cells, especially of those of the mesoblast, which furnishes the framework of the ovary, pass from their superficial position into the subjacent layer; in this change of place they carry with them ordinary epithelial cells, and thus each ovule is furnished with an envelope which is lined with epithelium, and so the ovisac or Graafian vesicle is formed. According to Pflüger, however, the changes are as follows: the proliferating germ epithelium sends prolongations into the forming mass of the ovary—inversions of the external covering—and thus tubes full of cells, and which become separated from the surface, result. Constrictions occur in these tubes and the portion between the two constricted parts, each bead in the strand representing a Graafian vesicle; the inversions of the external covering, at first tubular, become glandular cords.

FIG. 47.



HUMAN OVULE, AND OVULES OF RABBIT, PIGEON, AND ASCARIS.—*A*. Primordial egg (human) from a fœtus at the eighth month. *B*. Primordial follicle from a rabbit; *C*. from a pigeon. *D*. A somewhat older follicle from the same animal, exhibiting the commencement of the formation of the secondary yolk. *E*. Cœcal extremity of the ovary of the ascaris nigrovenosa. *F*. An egg of this animal. *G*. An egg from the follicle of a rabbit, 2 mm. in diameter; *a*. epithelium of the ovum; *b*. radially striated zona pellucida; *c*. germinal vesicle; *d*. germinal spot; *e*. yolk. High power.

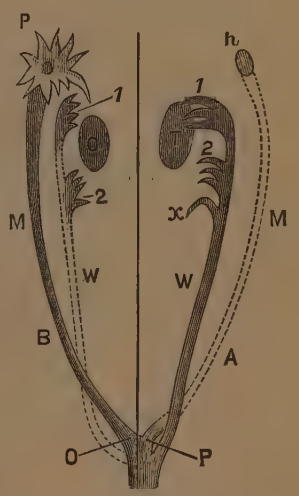
Dr. Foulis, from his investigations as to the development and structure of the ovary, denies the presence of tubular structures, and therefore the formation of Graafian vesicles as given by Pfluger. His statement is this: All[1] the ova are derived from the germ epithelial cells. In the development of the ovary small and large groups of the germ epithelial cells become gradually embedded in the ever-advancing stroma. Germ epithe-

[1] Transactions of the Edinburgh Obstetrical Society, vol. v. 1879.

lial cells do not grow downwards into the substance of the ovary. The ovarian stroma constantly grows outwards, surrounding and embedding certain of the germ epithelial cells. As these latter increase in size, and as the stroma thickens around them, the whole ovary becomes enlarged. Pflüger's tubes in the kitten's ovary have no existence as such, but are appearances produced by long groups of embedded germ epithelial cells, many of which groups are not completely cut off from the germ epithelial layer by the young ovarian stroma. Such growths of germ epithelial cells, in various forms, are met with in all ovaries, but have no importance whatever as tubular structures. No real tubular structures from which Graafian follicles are formed exist in the mammalian ovary at any stage of its development.

In reference to the general development of the internal generative organs, there is a certain period in embryonic life of sexual indifference, a period when the substratum for the evolution of a male or a female is alike, and nature gives no indication of her purpose in regard to which shall be produced. In this connection the homologies between the male and female internal generative organs are of interest; these homologies are well shown in the subjoined illustration from Duval.

Fig. 48.



Scheme of the Homology of the Internal Genital Organs of the Male (*A.* right side), and of the Female (*B.* left side).—*O.* Ovary. *T.* Testicle. *W.* Canal of Wolff; in the female it atrophies; in the male it forms the deferent canal. The genital part (1) of the Wolffian body is represented in the male by the epididymis, in the female by the body of Rosenmuller. The urinary portion (2) forms in the male the paradidymis, in the female the parovarium; it also forms in the male the vas aberrans (x). *M.* Canal of Müller; it disappears in the male. Its free extremity, which forms in the female the pavilion (*P*), forms in the male the hydatid of Morgagni (*h*). Its inferior extremity forms in the female the uterus and the vagina (*O*), and in the male the prostatic utricle (*P*).

Anomalies of development of the external sexual organs may be the cause of sterility, but chiefly interest the obstetrician in regard to the determination of sex in some cases of miscarriage, or in other instances, where labor occurs after the fœtus is viable.

At three months the clitoris is as long as the penis, and indeed from the relatively greater size of the former compared with other organs of the vulva in the early months of intra-uterine life, mistakes as to the sex may arise if a thorough examination be not made. At birth too, if there be congenital hypertrophy of the clitoris, similar error may occur, and a female be thought a male infant. The difficulty[1] is increased if not only the clitoris but also the labia majora be hypertrophied, for with the hypertrophy of the latter organs they may be united higher than normal, and may contain, as has been observed in some cases, the sexual glands. These anomalies may not only lead to mistakes as to the sex

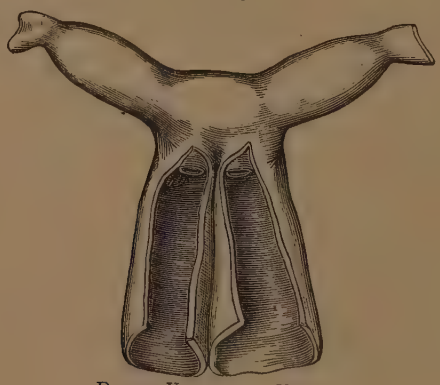
[1] Winckel.

in some cases, but in others to the assertion of hermaphrodism. These errors were much more frequent in ancient than in modern times, and led to the sacrifice of many new-born, for the supposed union of the sexes in an individual was regarded as so monstrous, that the Athenians threw into the sea, the Romans into the Tiber, all infants who were thought hermaphrodites. In almost all cases of alleged hermaphrodism this condition is *apparent*, not *real*, and arises when the external generative organs of one sex very closely resemble those of the other; it is called female hermaphrodism when this condition is observed in the female.

Anomalies of the uterus and vagina are in most cases plainly caused by arrests of development. Thus in case of duplicity of the vagina, the process of development was arrested after the union of that portion of Müller's ducts from which this organ originates, but before absorption of the intervening wall. If the vagina be double, usually the same condition is present in the uterus. In some cases one of Müller's ducts atrophies, but the other is developed, and a one horned uterus results. Müller's ducts may unite below the insertion of the round ligaments, and the uterus then has two horns. In some cases the fundus of the uterus is not developed, but the surface is depressed, and the organ is said to be heart-shaped, or cordiform. The dividing wall in the two parts of Müller's ducts may be complete, or the lower part absorbed; in the one case the condition is described as uterus septus, or bipartitus, and in the other as semisepsus, or semipartitus. None of these anomalies prevent pregnancy—even multiple pregnancy has been observed in the one-horned uterus, each child being perfectly developed; a fœtus may occupy each half of a double uterus, and normal labor occur at different times, showing that the conceptions were not cotemporaneous. Pregnancy in one horn of a uterus, especially if only one horn be present, may very closely simulate an extra-uterine pregnancy, and doubtless has in some cases been mistaken for such pregnancy.

Illustrations of some of these anomalies are presented in Figs. 49, 50, and 51.

FIG. 49.

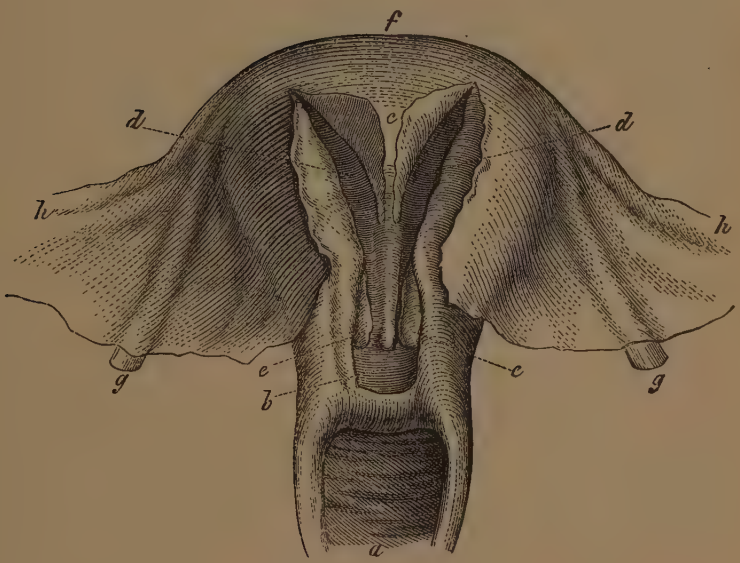


DOUBLE VAGINA AND UTERUS.

FIG. 50.

BIFID UTERUS.

FIG. 51.



PARTITIONED UTERUS.

The Mammæ.—During the first period of life external to the mother, the young of the class of animals known as mammiferæ are nourished by the secretion from certain glands of the mother which are called mammæ, while in intra-uterine life they were nourished by her blood. The word mamma is from the Greek μαμμα. It is remarkable that in many different languages almost the same word is applied to an organ so essential for the growth and development of the infant, and that this word is usually the one first spoken by the child.

The mammæ are usually two in the human female; they are situated one on each side of the chest[1] anteriorly, between two layers of the

[1] Plutarch, De Amore Prolis, thus explains the position of the mammæ in women: Itaque quidem animalibus ventrem ubera desinunt, mulieri superne ad pectus nascuntur, ut in promptu sit osculari, amplectique et fovere infantem: nimirum quia pariendi et alendi finis est non necessitas, sed amor.

superficial fasciæ upon the pectoralis major, corresponding with the space from the third to the seventh rib, and separated from each other by the space over the sternun. They are rudimentary in the male, and are also rudimentary in the female until she approaches puberty, when they notably increase in size, but only attain their complete development under the stimulus of pregnancy followed by lactation. The probable suggestion has been made that when females through a few successive generations fail to nurse their offspring, these glands become permanently lessened in size.

In many, if not in most cases, the mammæ are of unequal size, though authorities differ as to which, the right or the left, is larger; it is probable that the right breast is the larger in the majority of cases. A curious observation is attributed by Ploss[1] to the Israelite physicians of the Talmud: The daughters of the wealthy class have the right breast better developed than the left, because of the garment worn over the right shoulder; while the daughters of the poor have the left breast the larger in consequence of using the left arm in drawing water, and in carrying their younger brothers and sisters.

The mammæ are usually somewhat hemispherical in form; but they may be pyriform or conical, and are then by some regarded as indicating a more abundant secretion of milk. The volume of the breasts is not in direct relation with the vital power and force of the individual, nor do these organs if large necessarily indicate abundant supply of milk; in some women of delicate organization the breasts may be quite large, or again the great size in an individual case may not be from increase of the glandular tissue, but from an abundant deposit of fat.

With Charpentier it is convenient for description to divide the breast into three zones, in regard to its external surface. One of these zones, the peripheral, is very much the largest, and presents a smooth, white surface, beneath which the veins may be seen; if the female has given birth to a child, it is not uncommon to find the skin marked by *striæ*, *lineæ albicantes*, similar to those found upon the abdominal wall. The second or middle zone is composed of the areola. The color of the areola is in striking contrast with that of the peripheral portion; it is a pale rose in virgins, but becomes dark in pregnancy in brunettes, while it changes only slightly in blondes, or in those having red hair: the pigmentation occurring in pregnancy never entirely disappears. The areola is one to two inches, or 2.5 to 5 centimetres, in diameter. The skin of the areola contains many sebaceous glands, but in addition to these there are from twelve to twenty papular or tubercle-like projections, sometimes called the glands or tubercles of Montgomery, in regard to the nature of which different views are held. Milk may be discharged or pressed out of them during lactation, a fact which, according to Sappey, results from a communicating galactophorous duct, arising from a supplemental lobule of the mammary gland, but they are essentially sebaceous glands. De Sinéty and Duval, however, assert that they communicate with isolated miniature mammary glands, and, according to Depaul, they are rudimentary nipples. Whether sebaceous glands or nipples,

[1] Op. cit.

they are greatly enlarged in pregnancy, thus making one of the most distinctive mammary signs of pregnancy. Beneath the skin of the areola concentric circles of muscular tissue are found; these circles, widening as the periphery of the subareolar surface is approached, there cease; contrary to that observed in the peripheral portion of the breast there is no layer of fat beneath the skin.

The third or central zone is that occupied by the nipple. This rises from the centre of the areola, at a point corresponding with the fourth intercostal space; it is conical or cylindrical, rounded at the summit, and measures nearly half an inch, or twelve to thirteen millimetres, in height, and nearly a third less in thickness. In some subjects, however, the nipple is retracted, so that its upper surface is level with, or beneath the surrounding areola, presenting in the latter case a depression similar to the umbilicus. The surface of the nipple has nearly the color of the areola, and presents a somewhat rough appearance from the numerous thick-set papillæ beneath, and in these papillæ, according to De Sinéty, corpuscles of Meissner are found. It has no hair-follicles, but is abundantly supplied with sebaceous glands; generally a pair of these glands is found at the mouth of each of the fifteen to twenty galactophorous ducts which open at the summit of the nipple; the only part of the nipple where these glands fail is at its junction with the areola, a matter of some practical importance with reference to the occurrence of fissures at this point during lactation. The nipple is provided with both transverse and longitudinal muscular fibres; contraction of the former causes thelothism,[1] or projection of the nipple, from θηλή, nipple, and ὠθέω, to push, while retraction of the nipple results from predominance of the action of the longitudinal fibres.

Beneath the skin of the peripheral portion a layer of connective and of fatty tissue is found; it becomes thicker at the external circumference of the organ; the skin is supplied with sudoriparous and sebaceous glands and hair follicles. The mammary gland is racemose, and is composed of fifteen to twenty lobes, these being separated from each other by fibrous and fatty tissue; the gland mass is thicker at the centre than at the circumference. Each lobe is formed of a number of lobules, and each lobule, in turn, of cul-de-sacs, or acini. The structure[1] of an acinus from within out is as follows: First, a single layer of cubic cells; second, an incomplete sub-epithelial endothelium; third, the membrana propria; fourth, connective tissue abounding in cellular elements; and fifth, a fibrous tissue rich in elastic fibres and very poor in cells. A small duct passes from each acinus to unite with similar ducts from other acini, and by this union of ducts the larger duct of a lobule is

FIG. 52.

ACINUS OF THE MAMMARY GLAND OF AN ADULT FEMALE DURING LACTATION. —*a*. Epithelial cells. *b*. Nucleus. *c*. Nucleolus. *d*. Globules of milk. *e*. Fibres of connective tissue. *f*. Cells of connective tissue. Magnified 300 diameters. (From De Sinéty.)

[1] Duval.

formed; the ducts of the lobules of each lobe in their turn unite to form the excretory canal of that lobe, or the galactophorous or milk duct. The ducts thus formed, and equal in number to the entire number of lobes, convey the milk to the upper surface of the nipple; at the level of the areola the ducts undergo a fusiform dilatation, this dilated part is known as the lactiferous sinus. It is quite exceptional for the milk ducts to anastomose with each other. The milk ducts are lined with cylindrical epithelium; the ducts of the acini, near the latter, have the same lining as that of the glandular structure, and, like them, secrete milk.

FIG. 53.

STRICTURE OF THE BREAST.

The blood supply of the breasts is by the internal and external mammary and intercostal arteries; the blood is returned through the internal mammary and the axillary veins. The lymphatic vessels are very numerous, and, as described by Sappey, form two planes. The first presents a very delicate network beneath the areola and the nipple; the second is deep-seated, and is peri-lobular; the vessels do not penetrate into the lobules, but there are numerous lymph spaces in the connective tissue surrounding these. All the trunks from the deep layer of lymphatics are directed toward the areola, and they form a plexus remarkable for the size of the vessels; from this plexus two, in some cases three, trunks pass to the axillary ganglia. The lymphatics of the skin communicate with the sub-areolar plexus. The nerves come from the fourth, fifth, and sixth intercostals, from the thoracic branches of the brachial plexus, and from the sub-clavicular branches of the cervical plexus. According to Winkler the vaso-motor nerves come especially from the brachial plexus.

Development and Anomalies of the Mammæ.—"The first indication of the mammary gland is seen about the third month of intra-uterine life, consisting of an in-growth of cells of the *rete mucosum*, surrounded by the fibrous tissue of the skin. At about the fifth or sixth month the rudimentary ducts of the lobules are apparent, springing from the central collection of cells."[1] At birth the lobes are distinct, and the milk-ducts open at the nipple. A painful swelling of the breasts is sometimes observed in the new-born, male and female; it lasts four or five days, and there can be pressed from the nipple a few drops of colorless liquid, viscous, and finally milk.[2]

Polymastia is much more frequent than *amastia*.[3] The superfluous breasts are generally found in the axillæ, or below the normal ones,

[1] Shakespeare and Simes. Cornil and Ranvier's Pathological Histology.
[2] Bouchut. Traité Pratique des Maladies des Nouveau-Nés.
[3] William Sneddon, M.D. Numerical Anomalies of the Breast.

but they may be on the thighs, on the back, or in the groins; more rarely they are in the median line, but when here, unlike those placed in other abnormal positions, they do not secrete. There may be but one of these supernumerary organs, more frequently there are two, and a case has been reported in which there were five.

Absence of the nipple is very rare, imperforation less so, and imperfect development not at all uncommon. Hypertrophy of the nipple has sometimes been seen; in one instance this organ was as large as a pigeon's egg. Sometimes the increase of the nipple is in its length only; but even then it may be impossible for the infant to nurse. Deficient development of the mammary glands is not infrequent, and examples of primiparæ, especially of those American born, who cannot supply sufficient milk for their infants, are frequently seen. Many of these primiparæ whose secretion of milk is so scanty, may after subsequent pregnancies have an abundant supply—a tardy development of the glands occurring.

CHAPTER III.

PUBERTY—OVULATION—MENSTRUATION.

PUBERTY is that epoch in human life when the individual first becomes capable of reproduction. It occurs about two years earlier in the female than in the male, and the physical and psychical changes characterizing its advent, are more marked in the former than in the latter. The girl's pelvis enlarges and her breasts notably increase in size as she enters this period of life; the one change indicates preparation for childbirth, the other provision for the nourishment of the new-born. The external genitals are developed, and hair grows upon the mons veneris and upon the labia majora; the circumference of the neck is greater, and the voice changes; the body is fuller and more gracefully rounded, sharp, irregular and angular outlines are replaced by symmetrical curves, and new beauty of form and general expression is manifested—it is the springtime of female life, the bud unfolding into the flower. The girl passing into womanhood puts away childish things, turning from frivolous amusements, from the toys and plays, or from rude sports in which she has found pleasure, she enters a new life, has new thoughts, desires, and emotions. Hitherto she has been living solely in and for the present; but now the future with its lights and shadows, its hopes and fears, makes a large part of her life. She is more sensitive and reserved, and manifests a modest dignity, giving and expecting respect; her individuality becomes more manifest, her sense of duty stronger, and her ambition greater.

This remarkable transformation is the expression of important changes in the internal generative organs, especially in the ovaries, for if the latter be absent or undeveloped, the distinctive sexual characteristics fail. During infancy and childhood the ovaries slumbered; nature's forces were busy building[1] up the individual, and it is only when this end has been in good degree attained provision is made for the continuance of the race. The ovaries now awaken from their silent, inactive state, notably increase in size, and enter upon the discharge of their special function; they determine the sexual character, and for thirty years or more exercise a dominant influence upon the female organism; commonly designated as uterine appendages, in a true physiology the uterus ought to be regarded as their appendage. The function of the ovaries is the maturing and rupture of ovisacs, with the consequent escape of ovules which are thus offered for impregnation; this process is known as ovulation, and as it occurs independently of sexual congress, it is called spontaneous ovulation. Until recent years, physiologists have generally held that ovulation

[1] Spiegelberg.

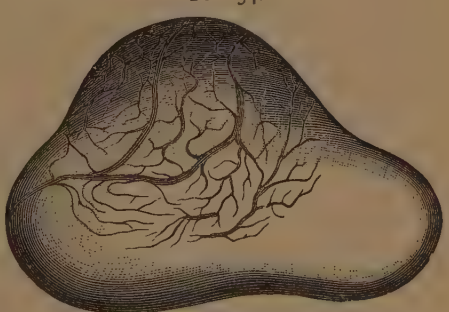
usually occurs at regular periods, but many now maintain that this is not true, and that the ripening and rupture of ovisacs go on independently of definite times; in a word, that ovulation is not periodical.

A hemorrhage from the uterus occurs at definite times during the reproductive period of a woman's life, except when she is pregnant or nursing, and to this process the name menstruation is given, while the flow itself is known as the menses, each term expressing the periodicity of the occurrence.

While reproduction is possible at the beginning of puberty, science and experience alike condemn such early exercise of this important power. As in the male, premature exercise of the sexual organs is, to use the words of Hufeland, the surest means of inoculating old age, so early maternity brings increased morbidity and mortality to the female, while her offspring will be less well developed, have less vital power, greater liability to disease and to early death than they would have had that maternity been delayed; the general law of both animal and vegetable world is that early reproduction gives an inferior product. Woman's form is not, as a rule, well developed before she is twenty years old; her pelvis, which has been called the laboratory of generation, has not its perfect shape until then; hence an earlier maternity is not advisable. Moreover, she lacks the mental and moral growth necessary for the grave responsibilities of motherhood. Modern physiology and large experience confirm the judgment of Plato, the wisest of Greeks, in his rule that "A woman may bear children to the State at twenty years of age."[1]

The physician, whose duty is not only to heal the sick, but also to prevent disease and to improve the race, and hence who must be a teacher of men and women, should teach sound doctrine in regard to the injurious results of precocious marriage. Mothers especially ought to be taught, though some have learned the lesson by their own sad experience, that puberty and nubility are not equivalent terms, but stand for periods of life usually separated by some years; the one indicates capability, the other fitness for reproduction.

FIG. 54.



OVARY WITH RIPE OVISAC.

Ovulation.—A brief statement of the process by which the ovule is liberated from the ovisac, and its following migration into the uterine cavity will now be given. The ovigenous layer at birth forms almost the entire ovary, but soon after the bulbous portion begins to increase in size, while the former remains without notable change in bulk until the approach of puberty. As this period draws near several of the ovisacs grow

[1] The Republic.

rapidly; one of them becomes prominent by its great development, it may be as large as a cherry, and forms quite a projection from the surface of the ovary, as seen in Fig. 54.

The growth of the ovisac causes increased flow of blood to the ovary; the emergent veins of the bulb having larger and thinner walls than the arteries bringing blood to it, are compressed by the contraction of the muscular tissue they traverse, and hence an increase of vascular tension in the entire organ, including not only the bulb, but also the ovisac. The contents of the sac augment, and its walls are more distended; the increased fluid in the ovisac is by some attributed to the breaking down of part of the cells of the membrana granulosa, or to a secretion of fluid by them; according to some an intra-vesicular hemorrhage occurs, in many cases the blood forms a clot, and the effused blood is one source of the distension. Rupture of the ovisac at last takes place, caused chiefly by distension, but also by fatty degeneration of the wall of the ovisac at its peripheric pole. An assisting cause, according to some, is muscular contraction of the ovary which has been depressed at that part where the ovisac was growing, and which under the stimulus of increase of blood, tends to efface that depression, thus lifting the ovisac out of its bed. Rouget believes that another factor in causing rupture is the action of the contractile coat of the ovisac. When the sac bursts the ovule surrounded by the proligerous disk escapes, and is received by the oviduct. With the development of the ovisac, there is a notable increase in the size of the ovary; this temporary increase affects chiefly the vertical and antero-posterior measurements, but only slightly the longitudinal measurement of the organ.

Various explanations have been given of the transfer of the ovule to the oviduct. According to Rouget, the real, the only possible mechanism, is that which depends upon the fact that the uterus, the ovaries, and the oviducts are formed of a common muscular membrane, and by the contraction of muscular fasciculi the pavilion is applied to the ovary so as to receive the ovule. In some of the inferior animals the ovary and oviduct are inclosed in a common capsule, and thus escape of the ovule into the abdominal cavity is effectually prevented. In the bitch this inclosing capsule has a narrow slit, but in the bear and otter, and in some other animals it is entire. This formation is attributed by Rouget to an accident of evolution which has become permanent.

Some have attributed the transfer of the ovule to the oviduct to the contraction of the elastic wall of the ovisac. A less improbable explanation is that which rests upon the presence, as first pointed out by Henle, of a gutter or canal upon the upper surface of the tubo-ovarian ligament through which the ovule passes into the oviduct, its progress being caused by the movements of the cilia of the epithelium belonging to this structure. It has also been asserted that the transfer is effected indirectly by the movements of the cilia of the pavilion, causing a constant current to the oviducts of the fluid moistening the peritoneum; the presence of this current has been proved by the fact that coloring matter introduced into the peritoneal cavity of animals,

is afterwards found in the oviducts and in the uterus. Cases of what is called the external migration of the ovule, that is entrance of the ovule into the oviduct of the left side, for example, when it was discharged from the right ovary, are thus explained; the vibratile current of the oviduct receiving the ovule is stronger than that of the one nearest which it is when the ovisac bursts.

After the ovule has entered the oviduct its further passage to the uterus is secured by the movements of the cilia, and by peristaltic contractions of the oviduct.

The experiments of Bruzzi[1] upon rabbits have conclusively proved that external migration of ovules occurs; thus, for example, he endeavored, but failed, to cause extra-uterine pregnancy by removing the ovary of one side, and ligating the oviduct of the other ovary, but copulation was followed by normal pregnancy, thus proving that the ovules coming from the remaining ovary had passed through the pervious duct of the opposite side.

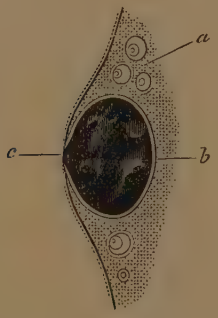
The ovisac—its size lessened by the escape of the ovule and its surrounding granular matter, and of serous fluid, and the rent through which these passed closing—undergoes certain changes, which result in its obliteration, the most notable of these being the formation of the *corpus luteum*, or yellow body. As observed by Raciborski, the term "yellow," as applied to these bodies, is incorrect; for while true of them as found in the ovary of the human female, yet in many of the inferior animals they do not have this color; thus, in the cow they are deep orange, in sows a whitish gray, etc. Hence he proposed as a substitute for corpus luteum the word *metoarion* from μετα, after, and ωαριον, the ovule, and some have adopted it; but corpus luteum, with its plural corpora lutea, is in such general use by obstetric authors that it will be retained. The formation of the corpus luteum is due chiefly to hypertrophy of the *membrana propria*, or *reticulata*, of the ovisac; the yellow color results from refracting granulations[2] more or less colored, either free or contained in cells; lymph cells are also found; the endothelial lining, or membrana granulosa, does not participate in the formation of the corpus luteum. Raciborski asserts that an intra-vesicular hemorrhage occurs prior to the bursting of the ovisac, while Dalton's investigations have led him to conclude that the hemorrhage is simultaneous with or immediately after the rupture; still others regard the hemorrhage as not constant, but accidental and occasional, and should it occur the process of the formation of the corpus luteum is hindered rather than assisted. Benckhiser[3] from his studies of the corpus luteum in swine, concluded that a coagulum was an inconstant and unnecessary condition for the formation of this body. I have examined very many corpora lutea in swine and in sheep, and have never yet found a blood-clot in the ruptured ovisac.

In consequence of the limited space offered, the membrana propria from its hypertrophy is thrown in folds like the cerebral convolutions; these folds project toward the cavity of the ovisac, and, crowded to

[1] Annales de Gynécologie, Janvier, 1885.
[2] De Sinéty.
[3] Archiv für Gynäkologie, 1884.

each other from opposite sides, meet and then unite, thus obliterating that cavity. The hypertrophy does not begin until after the ovisac has burst, and hence cannot be a cause of that event.

FIG. 55.



GRAAFIAN FOLLICLE OF THE HUMAN OVARY; recently ruptured during menstruation, and filled with coagulated blood; longitudinal section. *a*. Tissue of the ovary, containing unruptured ovisacs. *b*. Vesicular membrane of the ruptured follicle. *c*. Point of rupture.

FIG. 56.

HUMAN OVARY CUT OPEN; showing a corpus luteum divided longitudinally.

The growth of the corpeus luteum reaches its maxium in thirty days, according to Dalton, in ten according to Coste, and is followed by atrophy, so that at the end of eight or nine weeks there remains of the entire mass a mere lamina of fibrous tissue, situated just beneath a pit or depression on the surface of the ovary, marking the place where the ovisac burst; according to Robin, there may also be found, in some cases, fat globules, or free fat, and amorphous, or crystalline coloring matter. During the regression of the corpora lutea the color becomes much lighter, white, instead of yellow, so that they are sometimes called corpora albicantes.

FIG. 57.

HUMAN OVARY. Showing a corpus luteum, nine weeks after menstruation. From a girl dead of tubercular meningitis.

True and False Corpora Lutea.—Should the ovule be impregnated, the corpus luteum reaches a larger size and continues longer. Hence a distinction has been made between the corpus luteum of menstruation and that of pregnancy, the one being called false, the other true. But such terms are misleading, for these bodies, though, as before said, differing in size and duration, are essentially the same. The history of the corpus luteum of menstruation has been given. The corpus luteum of pregnancy grows for thirty or forty days after conception; it then remains stationary until the end of the fourth month, when it begins to lessen, so that at the end of nine months it has only two-thirds its

greatest size, and in a month after delivery is reduced to a small, indurated mass. In some cases, however, the growth of the corpus luteum of pregnancy may continue longer than has been indicated, while in others the regression may be more rapid; there is no absolute, only a general rule applicable to either.

FIG. 58.

CORPUS LUTEUM OF PREGNANCY AT THE END OF FOURTH MONTH. From a woman dead by poison.

FIG. 59.

CORPUS LUTEUM OF PREGNANCY AT TERM. From a woman dead in delivery from rupture of the uterus.

Menstruation.—This is a temporary and intermittent function of the female organism, and has as its most obvious phenomenon a discharge of blood from the genital canal. The function is temporary, for it does not begin until puberty, and it ceases in almost all cases when the reproductive period of life ends. It is intermittent, usually recurring at regular periods each month, but also presents longer intervals of absence, as during pregnancy and lactation.

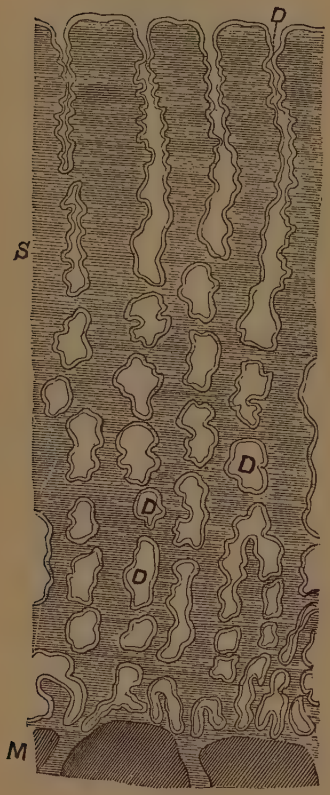
The study of menstruation includes that of its general and local phenomena, the character, duration, and quantity of the discharge, and its periodicity; the time of life when it begins, and that when it ceases; and the theories which have been proposed explaining its occurrence, especially in its connection with ovulation.

The general phenomena of menstruation are chiefly those connected with innervation and circulation. The reflex sensibility is increased; occasional chilliness and flashes of heat, neuralgic pains in various parts of the body may occur, and either light or grave manifestations of hysteria; some females during menstruation are drowsy, and few are disposed to exercise the usual activity of daily life, but rather seek rest, if not seclusion; sensitiveness to moral or to physical impressions is greater. There is in many cases congestion or irritation of various parts or organs of the body; the breasts may be swollen and painful; there may be sensations of fulness and throbbing pain in the head; the face is flushed in many cases, a dark circle is about the eyes, and an eruption may occur upon the skin; some are attacked with diarrhœa, many with irritability of the bladder; the thyroid gland is larger, and some have a mild tonsillitis.

The local phenomena are those connected with the generative organs. The external organs are swollen, and have increased sensibility; there are a feeling of fulness, of weight, and of "bearing-down" in the pelvis, backache, pain, or increased sensibility referred to the iliac fossæ, and some fulness or meteorism of the lower part of the abdomen. Few women when menstruating are entirely exempt from physical distress, so that the expression "being unwell" used for this function by many is something more than a mere euphemism.

Very important changes occur in the internal sexual organs. Increased determination of blood to these causes congestion, and in some a temporary hypertrophy. This transitory hypertrophy is especially manifested in the ovaries and in the uterus. The latter organ is increased in size one-fourth, one-third, or even more; its muscular fibres present a reddish appearance, and they are swelled and less firm. The mucous membrane, in consequence of excessive hyperæmia, is greatly swelled, and thrown into folds, "recalling by its anfractuosities and projections the aspect of the cerebral convolutions;" the orifices of the glands are more distinct, and pour out an abundant secretion, which is the prelude to the sanguineous discharge. The vaginal cervix is swelled and softer, and presents a deeper hue than in the menstrual interval; the os is somewhat open. The mucous membrane of the vagina presents a dark red, in some cases a violet color; it is swelled, and there is a slight elevation in its temperature. The phenomena of congestion and increased secretory activity are followed by hemorrhage.

FIG. 60.



SECTION THROUGH MUCOUS MEMBRANE OF THE VIRGIN WOMB.—*S.* Mucous membrane. *D.* Uterine glands with funnel-shaped stria. *M.* Muscular stratum. 40 x.

The hemorrhage results from the hyperæmia being so great that, according to some, rupture of the capillaries of the mucous membrane of the cavity of the body occurs. Menstruation in its congestion and discharge of blood has been called a diminutive of pregnancy, while Baudelocque spoke of it as a periodical abortion. The capillary tension immediately preceding the rupture of these vessels is explained by contraction of the muscular fasciculi inclosing the vessels of supply and return, this contraction affecting the veins more than the arteries, in consequence of the thin walls of the former, and by contraction of the muscular rings surrounding the large uterine veins.

While rupture of the capillaries is chiefly due to their great distension, fatty degeneration with detachment of the superficial epithelial cells is held by some to facilitate this rupture.

This statement is according to Dr. Engelmann's researches. Williams asserts[1] that the entire mucous membrane is cast off, thus leaving the muscular surface bare, and that a new mucous membrane is produced therefrom; the physiological objection to this theory is apparent and seems insuperable. Leopold states that fatty degeneration instead of preceding, and in any degree causing the menstrual hemorrhage, occurs during its progress. Fritsch[2] remarks that recently strong arguments have been adduced against these views, and that it is a mistake to attribute the hemorrhage to fatty degeneration, for in case of completely intact mucous membrane diapedesis occurs, the blood transuding from the vessels. We therefore return to the old theory which considered the hemorrhage as a result of the greatly swelled and distended vessels. Perhaps the arrangement of the vessels in the mucous membrane is important, for, according to Leopold, more vessels pass to than come from it.

Haller, Hunter, and many other illustrious physiologists and physicians regarded the menstrual flow as a secretion. Among American medical teachers, both the late Dr. Dewees and Dr. Hodge earnestly upheld this view. On the other hand, the late Dr. Charles D. Meigs[3] treated it with unsparing ridicule, exclaiming: "I leave it to the student, therefore, to settle with his own judgment the question how can blood-disks be the subjects of secretory action? Can solids be secreted? Could not a woman as well secrete a watch or a diamond ring as one single blood-disk?"

No one now maintains the doctrine that the menstrual discharge is a secretion, but all consider it a hemorrhage, though different explanations are given of its occurrence.

Character, Duration, and Quantity of the Menstrual Flow.—At the beginning of the monthly flow the discharge is chiefly serous or mucous, slightly tinged with blood, but as it continues the number of red globules increases until it is almost pure blood, having the color of that which escapes from a vein, though Dewees described the color as resembling that of mixed arterial and venous blood. The color, however, varies; thus, it may be very light, and the fluid almost watery in the chlorotic, and excessively dark if there be great venous congestion. The odor of the menstrual fluid has been compared to that of the marigold; it is due, in most cases, to long retention of the fluid in the uterus, or in the vagina, or else to the admixture of secretions from the genital glands. The fluid contains, in addition to red globules, white cells, globules of mucus, and epithelial cells from the uterus and from the vagina, the last increasing at the end of the discharge. It is alkaline, and usually does not coagulate; the non-coagulation is generally attributed to the intimate mixture of the glandular uterine secretions with it, but Delore says that the blood flows so slowly from the uterus that it is in part defibrinated; however, the discharge of clots is frequently observed if the flow be profuse, and in some cases without this condition being present.

[1] Obstetrical Journal of Great Britain and Ireland, 1875.
[2] Krankheiten der Frauen.
[3] Obstetrics: The Science and Art.

The quantity of the discharge was asserted by Hippocrates to be eighteen ounces, but the usual estimate is four to six ounces, or about 128 to 192 grams. According to Tarnier, if the flow amounts to 500 grams, or between thirteen and fourteen ounces, there is menorrhagia. Sims suggested that by the number of napkins needed in twenty-four hours, the quantity could be determined; in a normal menstruation only three or four napkins being required in that time.

Many have regarded climate as an important factor in determining the duration of the menstrual flow; among recent authorities, for example, both Playfair[1] and Harris[2] refer to this flow as being more profuse in warm climates; cold climates, on the other hand, have been thought to lessen the flow. This belief, according to Raciborski,[3] is especially founded upon the old theory of menstruation which regarded it as resulting from plethora. He quotes the statistics of Faye, of Christiana, and of Peixoto, of Rio Janeiro, showing that the menstrual epochs and the quantity of the flow in these climates present the same variations which are met in central Europe. Saint Vel, whose observations were made in Martinique, regarded climate as without influence, but attributed the menorrhagia from which European women might suffer, as owing to the anæmia resulting from malarial infection, and thus they were predisposed to the increased flow. The observations of Hewan upon menstruation in women upon the coast of Old Calabar, showed that the flow lasted from three to four days; and those of Rochebrune[4] in regard to this function in the Woloff negresses, that it lasted only three days, and was slight.

F. Weber[5] has shown that at St. Petersburg the earlier or later beginning of menstruation has but a subordinate influence in the amount of the discharge; but he attributes an important role to the bodily constitution and the color of the hair. He rejects the opinion that menstruation is more profuse in brunettes than in other women, since it is very often profuse in blondes, and especially in women with red hair.

A generous diet increases the flow, while it is lessened by scanty and unsuitable food. Excessive sexual intercourse may cause the flow to be greater, and so, too, a profound mental impression—though in most cases this arrests it—may for the time have such an effect. Idiosyncrasy in many cases has an important influence, and, as so earnestly asserted by the late Dr. Hodge, every woman is a law unto herself as to the quantity of the monthly discharge, so that a physiological amount in one may be pathological in another. The best criterion of a normal flow is the effect upon the general health; if that be not injuriously influenced the flow is neither too great nor too small.

Hippocrates declared that the menstrual blood was as pure as that of a victim. Nevertheless this just opinion has not been held by primitive people; among them the menstruating woman was unclean,[6] and even

[1] System of Midwifery.
[2] Notes to Playfair's Midwifery.
[3] Traité de la Menstruation.
[4] Revue d'Anthropologie, 1881.
[5] St. Petersburger med. Wochenschrift, 1883.
[6] The Mosaic regulations as to menstruation are well known. It is stated by Raciborski and others that these were founded upon a wise hygiene, since the investigations of Diday, of Lyons, have proved that a chronic urethritis in the male may be caused by coitus during

one of the most learned of ancient Romans, Pliny,[1] has attributed to the monthly discharge such serious results that his statements are amusing from their absurdity.

Recurrence and Duration of the Flow.—The intervals between menstruations are not the same for all women, and seldom, in rare cases only, the same for the individual; variations of a day or more are frequently observed, the flow either delaying or anticipating, in most women. The terms menses, catamenia, "monthlies," Monatsfluss, etc., point to the monthly recurrence of this function; so, too, the word moons, used by the Chinese for this flow, has similar significance; it also points to the old belief of this function being subject to lunar influence. Goodman's statistics show that from the middle of one menstruation to the middle of the next is a fraction under twenty-eight days, or nearly one lunar month.[2] On the other hand, according to Dubois and Courty, the typical interval is a solar month; this is also the statement of Stoltz. Deviations from this interval may be observed, thus one woman may menstruate every three weeks, or even more frequently, while another may have the flow only once in six or eight weeks.

The duration of the discharge varies; usually it is from three to six days; it is probable that, as stated by Hippocrates, a larger proportion of women have the flow three than any other number of days. In some the discharge lasts but one or two days, while in others it continues eight or ten. In this, too, we are reminded that every woman is a law unto herself.

Causes Influencing the First Menstruation. Climate.—In temperate climates girls usually begin to menstruate when from thirteen to fourteen years old; in warm climates the function occurs earlier, in cold later. Raciborski[3] states that a year's difference in puberty corresponds to a difference of eight, of nine, sometimes of only four, degrees of latitude. His tables, including 25,952 observations, show that there is a difference of three years, ten months, and thirteen days between the time of the first menstruation of girls living in Central Asia, and in that of those living in Lapland. Krieger[4] gives as the two extremes, eighteen years in Swedish Lapland, and ten years each in Egypt and in Sierra Leone.

menstruation; moreover it is probable that the menstrual fluid would have peculiarly irritating properties in the climate of Egypt. Even during some of the earlier Christian centuries women were considered unclean while menstruating, and not allowed to partake of the "communion." Ploss observes (op. cit.), after referring to the general belief of the uncleanness of a menstruating woman, and the regulations to which she was then subjected, "We find such rigid rules, in which hygiene and religion unite, especially in the Indo-German race, in the Indian, as well as the Semitic, Jewish, and Arabian."

[1] He asserted that at the approach of a menstruating woman must was made sour, seeds touched by her became sterile, garden plants are from like causes parched, and grafts wither; the fruit falls from trees beneath which she sits, her glance dims the brightness of mirrors, blunts the edge of steel, and removes the polish from ivory; dogs licking the discharge are seized with madness, and their bite is venomous and fatal.

There may be appended to this terrible invective the statement that one of the fables as to the death of Lucretius is, that his jealous wife compelled him to drink menstrual blood, and madness with death followed. Paracelsus asserted that the devil made of this discharge spiders, fleas, caterpillars, and all other insects that infest the air or earth.

[2] Transactions of the American Gynæcological Society, vol. 2.

[3] Op. cit.

[4] Die Menstruation.

Race.—The daughters of English residents in India do not menstruate as early as Hindoo girls. "Negresses born under the burning sky of Africa or of South America, menstruate early, and those born in Europe are equally precocious."[1] The Jewish race, which so strikingly keeps its individuality in all ages and places, and among all peoples, shows in regard to the first occurrence of menstruation but little differences of time, no matter what differences of latitude are compared.

Residence.—Girls living in cities usually menstruate earlier than those living in the country. The country girl has a simpler diet, breathes a purer air; she has regular and abundant time for sleep, and is much less exposed to special causes of nervous excitement which are so prevalent in cities.

Theatres, dances, novel reading, frequent association with the male sex in schools or at parties, too constant or improper musical culture, too rich and stimulating food, witnessing, if not at times participating in fashionable life, are among the factors which hasten female puberty in cities. It has been stated by physiologists that girls working in factories or elsewhere, constantly associated with males, have in many cases precocious menstruation. On the other hand, there are many girls in our large cities whose puberty is delayed. These are found among the very poor. They have insufficient food, are poorly clothed and housed, denied fresh air and sufficient rest, and compelled to toil beyond their strength; their growth is checked, their bodies stunted, and hence failure in the vital power needed for sexual development.

Heredity.—This influence, independent of race, is observed in some cases. Thus a mother menstruates early or late, and the peculiarity is transmitted to her female descendants.

The Genital Sense.—The genital sense has been defined by Raciborski as the greater or less vigor shown in the development of ovisacs; it varies greatly in individuals, and has an important influence in determining the time of the first menstruation. In some cases it proves superior to the influence of climate, and hence there may be precocious menstruation in cold, and delayed menstruation in warm climates. It is often hereditary. Precocious menstruation is to be attributed to the great power of the genital sense. Some years ago I reported[2] a case where menstruation began at three years and a half, and continued regularly. Ploss has collected forty-five cases of precocious menstruation, the oldest of the subjects being in her eighth year. But in some of these cases there was disease of the ovaries, in others hydrocephalus, and in still others rickets; nevertheless, the majority were healthy. In some of the cases of precocious menstruation, precocious maternity was observed.

Raciborski has given the name of emmenic monstrosities to infants or children who menstruated.

Apathy of the genital sense is manifested by delayed menstruation[3]

[1] Depaul. [2] Cincinnati Journal of Medicine. 1866.

[3] According to Villaret, Joan of Arc was "exempt from the tribute which women pay the moon;" and he suggests that this exemption was due to her high destiny. She was only twenty years old when executed, so that admitting the fact of her amenorrhœa, it is possible she had simply delay in the establishment of menstruation.

in persons whose health is good. This delay may extend to four or five years, or even a longer time, beyond the period when menstruation usually begins; in some instance menstruation did not occur until after one or more pregnancies, but of course the probability of conception prior to the establishment of this function is very small.

The Menopause.—The menopause, from μην, month, and παυσις, cessation, is the end of the menstrual life. It is influenced by various causes, such as social condition, climate, and race; and hence presents as great differences in time as does the beginning of menstruation. The menopause occurs somewhat sooner in the poor than in the rich, probably earlier in cold than in warm climates, and also in the black races than in the white. Some cease to menstruate in the third decade, while in others the function is continued into the sixth, thus Courty mentions the case of a woman who still menstruated regularly at sixty-five years. Charpentier states that in a woman under his observation menstruation ceased at forty-eight, but, after being absent for twelve years, returned, and continued for two years, the recurrence and quantity being normal.

Gibbon, in the Decline and Fall of the Roman Empire, states that Asima, the mother of Abdallah, when she was ninety years of age, upon hearing that her son was dead, had her menses return. Elsewhere it is stated that the flow was fatal in five days. Such hemorrhage and at so advanced an age would not be regarded by a physician as menstruation.

If the puberty be early, the menopause will be late, while on the other hand delayed puberty indicates early cessation of the monthly flow. According to Pétrequin's statistics,[1] one-eighth of women cease to menstruate when between thirty-five and forty years of age, one-fourth from forty to forty-five, one-half from forty-five to fifty, and one-eighth from fifty to fifty-five.

The obstetrician should remember that as girls have conceived before menstruating, so conception has occurred months and even years after the menopause.

Theories of Menstruation. Connection between Menstruation and Ovulation.—Probably the earliest theory of menstruation is the chemical or that which holds that certain materials which would otherwise be injurious to the organism, are eliminated by the discharge. This view was to some degree expressed by pronouncing a woman unclean during the flow; even to-day, as remarked by Fritsch, the expression *monatliche Reinigung*, monthly cleansing, is retained.

In recent years the doctrine has to a slight degree found a scientific basis in this, that the quantity of carbon burned by man increases up to thirty years, while in the female who menstruates it remains the same, and hence, according to Aran, menstruation serves to eliminate a certain amount of carbon from her organism.

The theory that the flow results from plethora is one of the oldest, and most generally adopted. As the woman had to nourish the unborn babe she was supposed to be endowed with superior blood-

[1] Quoted by Tarnier.

making power. But if she did not conceive, a superfluous quantity of blood was made, and nature brought the entire amount in her body to the normal level by periodical hemorrhages from the womb.

Some made the function peculiar to civilized women. Thus Rousel asserted that in the primitive or savage state women were exempt from menstruation; hard work and simple fare prevented them from being plethoric, and hence no hemorrhage occurred as it was not needed; but it was necessary in the case of civilized women, because they had less exercise and more abundant and better food.

Auber also denied that menstruation occurred in savage women, and asserted that it happened in the civilized because of failure to gratify the reproductive instinct, and thus became a habit. Some recent writers too, have sought to establish the pathological character of menstruation; in other words, menstruation is a disease which impregnation would prevent. For the moment admitting that Auber's theory is correct, that is, menstruation occurs from failure to satisfy the reproductive instinct, it has been suggested that a girl might be impregnated prior to menstruation, and then as soon as possible after her delivery let her be again impregnated, and thus through her entire reproductive life. At the end of that life she would have given birth to thirty or forty children, and if her example were to be generally followed, society would demand a new proclamation of Malthusianism. It is hardly necessary to state that menstruation occurs in savage women, and there is not the slightest probability that at any period in the history of the race in any land women ever lived who, as a rule, became mothers without being subject to menstruation. It has been suggested that the menstrual hemorrhage is for the purpose of relieving a local plethora, that of the sexual organs, especially of the uterus, hypertrophy of its mucous membrane with consequent formation of a deciduous membrane being thus prevented.

Dr. John Goodman has advanced the theory that menstruation is dependent upon a law of monthly periodicity. This law is the resultant and exponent of recurring cycles of physiological acts; these monthly cycles are supposed to depend upon the ganglionic nervous system. But, as remarked by De Sinéty, to attribute the flow to the nervous system explains nothing.

Passing from these theories, which have little more than mere historical interest, we turn to that which is founded upon ovulation, and which, though different explanations of the relations between the two phenomena may be held, meets with general professional acceptance. The view that has hitherto been commonly received, and is still held by many, is that ovulation is periodical, the growth of an ovisac and its rupture corresponding with each menstruation. As the ovisac grows it presses upon ovarian nerves, and by reflex irritation causes congestion of the internal generative organs, especially of the uterus; the uterine hyperæmia results in hemorrhage from its mucous surface. Here the question arises as to whether this hemorrhage is facilitated by desquamation of the superficial epithelium, resulting from fatty degeneration, complete casting-off of the mucous membrane being rejected. According to some this superficial desquamation does not occur until

the close of menstruation, and therefore has nothing to do with the hemorrhage. Again, excellent authorities state that they have failed to find the proof of elimination of the superficial portion of the mucous membrane in menstruation. De Sinéty, in examining the discharge during the monthly flow, could not discover the least fragment of mucous membrane or of epithelium; so too, in women dying while menstruating, he found the uterine mucous membrane entire in all its extent. Winckel[1] says: "Since Ruge and Moricke have found that during menstruation the ciliated epithelium of the uterine mucous membrane remains intact, an observation which we have repeatedly confirmed, the earlier view that during menstruation a fatty degeneration of the superficial layers was a cause of menstruation is incorrect."

Admitting these statements, the necessary conclusion is, that the hemorrhage in menstruation occurs without destruction of any part of the uterine mucous membrane, and that the blood escapes from the superficial vessels, not by their rupture, but by diapedesis and through an intact mucous membrane.

The periodicity of menstruation can be most readily explained by attributing it to the ripening of an ovisac, for this, like other processes of growth, would naturally be supposed to require a certain time. Again, this interpretation of the connection between ovulation and menstruation, corresponds with what we know of ovulation and "rut" or "heat" in animals, which is the analogue of menstruation. Nature's legislation is general rather than special, and it is not probable she would make one law relating to reproduction for animals in general, and then a special law for human beings.

But without pressing this point, let us see the proofs that are adduced to show that ovulation is not periodical. The results of Leopold's investigations are thus given by Foektistow:[2] Fully developed follicles, those already ruptured, and fresh corpora lutea may be found at any time during the inter-menstrual period. These may not be present during menstruation. Hence ovulation occurs without menstruation, and menstruation may occur without simultaneous rupture of the follicles. Ovulation therefore is independent of menstruation, and is not periodical. Nevertheless, while Leopold denies the dependence of menstruation upon periodical ovulation, he does make it depend upon the ovaries, and he regards its periodicity as placing it in the category of rhythmical manifestations, *e. g.*, the pulse, respiration, or ejaculation of semen.

The uterine hyperæmia results as a reflex from the ovaries caused, not by the ripening of an ovisac, but by the continued growth of several. Foektistow, in answer to the question why does not menstruation occur more frequently, gives these reasons: Comparatively slight ovarian irritation is not sufficient to cause a reflex so soon. The essential too, of the menstrual process, is that anæmia follows hyperæmia, and irritability ceases. Equilibrium is restored, and to cause another reflex another sum of irritations is necessary, and these cannot

[1] Lehrbuch der Frauenkrankheiten. 1886.
[2] Archiv für Gynäkologie, Band xxvii.

occur at once. The changes in the uterine epithelium which began with the hyperæmia, pass away with the following anæmia, and the epithelium returns to its normal condition, a process which continues through more than one-half of the inter-menstrual period.

Another theory of menstruation which is founded upon ovulation, is that of Lowenthal.[1] According to him the ovule reaches the uterus before impregnation; if it be impregnated, menstruation does not occur, but if it is not impregnated, it excites a uterine congestion which ends in hemorrhage. Winckel[2] observes the Achilles heel of this bold hypothesis is that the death of the ovule can cause active congestion of the uterus. Further, this hypothesis is a revival of an old one, that is, menstruation results from the failure of impregnation, and is entitled to no more credence in its new than it was in its old form.

It may be, as stated by De Sinéty, that any positive theory of menstruation is, with our present knowledge, premature; nevertheless it must be admitted that this function is connected with the ovaries, for if these organs are congenitally absent, or if they are undeveloped, menstruation does not occur. So, too, after double ovariotomy menstruation ceases. The exceptions to this rule cannot be admitted until a careful post-mortem examination has proved that no fragment of ovarian tissue has been left behind in the lower portion of the pedicle, as has happened in some cases. Women have borne children after both ovaries were believed to have been removed. Olshausen performed, as he thought, ovariotomy, but the result being fatal he found at the autopsy that neither ovary had been removed. Further, even if both ovaries have been completely removed, possibly there may remain a supernumerary ovary, a condition that Beigel's and Winckel's examinations[3] prove to be far less rare than has been thought. Until in those cases of alleged perfectly normal menstruation[4] post-mortem examinations prove the entire absence of all ovarian tissue, either a fragment of an organ that has been removed, or a supernumerary ovary, the doctrine that menstruation depends upon ovarian action will remain. So, too, it is in the highest degree probable that there is an intimate connection between ovulation and menstruation. At the same time it must be admitted that the two may be distinct, the one occurring without the other, though they are usually associated. Thus there may be occasional menstruations without ovulation, or the latter may occur without the former. Ovulation may begin before the first monthly flow, and impregnation take place; during lactation it may occur without menstruation, and it may happen too after the menopause.

[1] Archiv für Gynäkologie. 1885. [2] Op. cit.

[3] Beigel found in 500 sections supernumerary ovaries 23 times. Winckel from his own examinations concluded they were present in 3.6 per cent.

[4] Foektistow.

PART II.

PREGNANCY.

CHAPTER I.

CONCEPTION—EARLY DEVELOPMENT OF IMPREGNATED OVULES—FORMATION OF DECIDUOUS MEMBRANES—FŒTAL APPENDAGES.

CONCEPTION, from *concipio*, in metaphysics means a grasping into one, and in physiology the union of two living elements, one male the other female, the first phenomenon in the process of reproduction. Fecundation and impregnation are also used as synonyms, and by some incarnation is given the same meaning.

A woman who has conceived is pregnant; pregnancy begins with conception, and its normal end is labor. Pregnancy is simple, or single if only one ovule has been fecundated, but multiple if two or more have been. It is normal when the uterus contains the fecundated ovule or ovules, but abnormal, or extra-uterine if it or they be external to it. But whether the pregnancy be simple or multiple, whether it be normal or abnormal, its beginning is essentially the same.

Human conception, the initial phenomenon of reproduction, was a subject of great interest to students of nature, whether philosophers or physicians, in ancient times. Many and some remarkable hypotheses[1] have been suggested to explain conception, and indeed it is only in comparatively recent times that, guided by the discoveries of the microscope, it has been placed upon a basis of science.

Aristotle compared the menstrual blood to a block of marble, while the seminal fluid was the sculptor, and the fœtus the statue. Galen, who from his dissections had some knowledge of the ovaries, and gave them, as has been previously stated, the name *testes muliebres*, held that they furnished a secretion which in the womb combined with the seminal secretion of the male to form the new being. For many centuries these two opinions alternately prevailed, now one, and again the other receiving the more general acceptance. But they were alike rejected by the recognition of Harvey's aphorism, *omne vivum ex ovo*. This illustrious physician maintained that reproduction in all animals

1 "Drelincourt, an author of the last century, brought together as many as two hundred and sixty-two groundless hypotheses concerning generation from the writings of his predecessors, and nothing is more certain, quaintly remarks Blumenbach, than that Drelincourt's own theory formed the two hundred and sixty-third." (Allen Thomson.)

was by a female element analogous to the egg of the hen. But in explaining the way in which development of the egg was effected, he accepted the hypothesis of a seminal aura; fecundation occurred in like manner to the action of a magnet upon iron, contact with the former caused the latter to have magnetic virtue; again, he illustrated physical by mental conception—the uterus conceives the fœtus, as the brain ideas that are formed in it.

Confirmation of Harvey's views as to the essential element in human generation was for a time given by De Graaf's discovery of the ovisacs, which were believed to be human eggs, and at first were known as *ova Graafiana*. But in or before 1677, Ludwig Hamm, of Dantzic, examining with a microscope the discharge occurring in the nocturnal emission of a patient suffering with gonorrhœa, discovered living spermatozoids. He made known the fact to the great microscopist, Leeuwenhoek, who also saw them; the latter soon after found them in the seminal discharges of healthy men, of the dog, of the cat, and of the rabbit. His conclusion was that man is not produced from imaginary eggs, but from animalculæ, or little worms which are contained in human semen; he asserted the *sperma humanum parvulis puerulis esse plenam*. These supposed animalculæ received the name of spermatozoa, the plural of spermatozoon, but as these terms indicate that the objects are independent existences, a view now held by only few, it is better that they should be replaced by spermatozoid and spermatozoids.

Leeuwenhoek believed that the spermatozoids had sexual character, and some observers went as far as to describe their sexual organs. Of course the Harveian theory of reproduction was for the time rejected; and this process was simply the development of one of these homunculi in the uterus, the female merely furnishing a nidus for that development. But the progress of science has vindicated the truth of Harvey's theory as to the origin of the human being, and of all animal life; it, however, gives no support to the hypothesis of a seminal aura which acting upon the ovum causes its development. We now know that there must be an actual combination of the male and the female element in order that fecundation can occur.

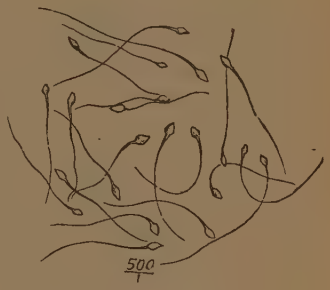
The Seminal Fluid.—Having previously considered one of the two elements essential for conception, the ovule, we now briefly study the other, the spermatozoid. This element is contained in the seminal fluid. The semen, when ejaculated, presents an appearance somewhat like that of thin, recently boiled starch; it is alkaline, and mucilaginous, and has an odor which is called spermatic, and has been compared to that of hemp flowers or of horn filings. The odor, according to Robin, does not belong either to the spermatic or to any other of the secretions that combine with it during the ejaculation, but is developed by the mixture. Its specific gravity is somewhat greater than that of water; it is not coagulated by acetic acid or by heat, and does not contain albumen, but the substance found in it, which has been by some given this name, is spermatine; after it has become dry it presents upon the stiffened linen where it has been deposited yellowish-gray stains; the quantity discharged at a single ejaculation varies

from fifteen grains to two drachms, one to eight grams. Chemical analysis shows the presence of ninety per cent. of water, six of extractive matters, three of lime phosphates and muriates, and one of soda. In the sperm of the bull, Kölliker found 820 parts of water, 151 parts represented by spermatozoids, 26 by salts, and 21 by fat containing lecithine. In the sperm of some men there may be an excess of spermatozoids with a deficiency of water—all fish and no water, as Pajot has said—and sterility be the consequece. With the microscope there are seen cylindrical cells, pavement epithelium, leucocytes, fine granular matter, crystals of lime phosphate, and the essential element, the fertilizing agents, spermatozoids.

Spermatozoids.—The form and size of spermatozoids vary in different animals, but there is no relation between the size of the spermatozoid and that of the animal from which it comes; thus the spermatozoid of the elephant is no larger than that of man, while that of the rat is five times as large.

The spermatozoid is composed of a head, of a tail, and of an intermediate segment, the last being thus designated by some, but by others called the body. The entire length of the human spermatozoid is not more than $\frac{1}{500}$ to $\frac{1}{625}$ of an inch, or one-twentieth to one-twenty-fifth of a millimetre. The head is pyriform, or ovoidal, the larger end being attached to the body or intermediate segment, while the smaller end is free. The head is about one-twentieth the length of the tail, and is quite or nearly twice as long as it is broad. The body, intermediate segment, or beginning of the tail, is only $\frac{13}{100000}$ to $\frac{10}{100000}$ of an inch, or one-three hundredth to one-four hundredth of a millimetre; it is oval and flattened, giving it somewhat the shape of an almond. The tail, or caudal filament, is thick at its origin, then gradually diminishes until its extremity is so fine as not to be visible even with the best magnifying glasses. One of the most striking characteristics of spermatozoids is the power of executing quick and rapid movements; these movements are especially rapid immediately after ejaculation; a spermatozoid moves a distance equal to its own length in one second, and it was stated by the late Dr. Marion Sims, that spermatozoids pass from the hymen to the neck of the womb in three hours. The head is the part which always advances first; the movements have been compared to that of an eel swimming in water; the tail may be curved in a circle, but very quickly becomes straight again, and its simple undulatory movements, which cause progression of the spermatozoid, are resumed; in its progress over the field of the microscope, it may sometimes be seen to abruptly push out of its way epithelial cells or crystals ten times its size.[1] The movements gradually become less, then there is no pro-

FIG. 61.



SPERMATOZOIDS.

[1] Robin.

gression, but mere oscillations are seen, and finally all motion ceases; but by warming the slide, if it has become cold, or by adding a little warm water, slightly alkaline, if the liquid has become thick, they are resumed. In avoiding these two causes of death to the spermatozoids when the seminal fluid is placed between two glass slides, the movements may last for twelve, twenty-four, or even thirty hours.

Spermatozoids have been found alive in men who were executed seventy, and even eighty-two hours after death; in the bull six days after it was killed; in the oviducts of bitches and rabbits seven to eight days; in the cow six days after copulation; in the human female they were found endowed with active movements in the cervical canal, by Hausmann, seven days and a half, and by Percy eight days after coition. In the female bat they retain their fecundating power for many months, and in the queen bee for more than three years. The spermatozoids of a frog may be frozen four times in succession without killing them. They will live for seventy days when placed in the abdominal cavity of another frog. (Montegazza.)

Acid solutions kill spermatozoids very quickly, and, on the other hand, weak alkaline solutions quicken or awaken their movements; cold water arrests their movements, and corrosive sublimate, one part to ten thousand of water, is destructive to spermatozoids, while they seem insusceptible to the action of poisons of organic origin.[1] The normal secretion of the uterus, as well as the menstrual discharge, is favorable to their movements. In the examination of spermatozoids, a magnifying power of three hundred diameters is sufficient, but in medico-legal investigations one of five hundred is necessary.

In temperate climates boys of twelve years may have a discharge simulating the seminal fluid, but it is unusual for spermatozoids to be found in these discharges before boys are fifteen or sixteen years old.[2] The reproductive power begins somewhat earlier in woman than in man, but it lasts much longer in the latter; Liegéois, from his investigations, concluded that about one-half of men between sixty and eighty years of age were capable of fecundation.[3]

Men who are addicted to sexual excess may have seminal discharges without any spermatozoids being present; so, too, spermatozoids may be absent in the case of some men who are in good health; thus Pajot found this condition in six of eighteen husbands whose marriages were sterile, and S. W. Gross states, as an approximate estimate, that in one case in six of sterility the husband is at fault.

As has been previously stated, the animalcular character once given to spermatozoids is now generally denied. The arguments against this view are: they have neither organs of digestion nor of reproduction;

[1] Duval.

[2] In the light of the statement above made as to the time spermatozoids are first found, the story of Cato being a father at eight years, as well as that said to have been told by St. Jerome, of a boy ten years old, who, sleeping with his nurse, impregnated her, is to be rejected.

[3] The illustrious Corvisart was sceptical as to the prolonged power of propagation, for when the first Napoleon asked him if a man at sixty could be a father, he replied, "Sometimes." "And at seventy?" then asked the emperor. "Always, sire."

they are anatomical unities which have their genesis from embryonic male cells or spermatoblasts, but they do not produce such cells; they indicate a finality, not a progress; they are regarded as similar to ciliated epithelium.

In order that fecundation shall occur there must be an actual union between the male element and the female—between the spermatozoid and the ovule. In some animals external fecundation occurs, the eggs being fertilized after they have been expelled from the female; or, as in the frog and crab, while they are being discharged. But in human beings, as in most animals, fecundation is internal. The place of union, between the spermatozoid and the ovule, was supposed to be the uterine cavity, and a few still hold this opinion. But this opinion is rejected because it will not explain the occurrence of extra-uterine pregnancy, and because the spermatozoids are found in the inferior animals to have entered the oviducts and advanced to the pavilions. In the hen, that after being covered once, then separated from the cock, lays a dozen fecundated eggs, the spermatozoids are found in vast numbers in the pavilion. Moreover, it is known that in some animals the ovule in its progress through the oviduct becomes covered by a coating of albumen which is impenetrable by spermatozoids, and also, that unimpregnated, it is affected during this progress by degenerative changes, which render impregnation impossible. It is therefore now generally held that fecundation takes place in the oviduct, probably near or in the pavilion.

Ascension of the Spermatozoids.—Various theories have been suggested in explanation of the means by which the spermatozoid reached the ovule. In coition a vast number of spermatozoids is usually deposited in the posterior vaginal cul-de-sac. Riolan, Morgagni, Boerhaave, and others have asserted that the uterus drew in the seminal fluid; and this view is strengthened by the hypothesis of the erectility of the organ, because, during the erection, supposed to occur in coition, the walls of the uterus become separate and rigid, thus increasing the cavity. Others have asserted that alternate expansion and contraction of the cervix take place under the stimulus of sexual excitement, and thus the fluid is drawn into the uterine cavity—a sort of sucking movement effecting its entrance. But neither of these theories, one of which is mainly speculative, and the other resting upon too few observations, and those made in case of disease, explains impregnation when the body of the uterus is affected by fibroids, or the neck by cancerous infiltration, or those where intro-mission has not occurred, either as a supposed precaution against pregnancy, or because of a resisting hymen, or of vaginismus, and the semen has been deposited upon the external sexual organs. Coste held that the ascension of the spermatozoids was due to capillary action. As water ascends a capillary tube, or between two plates of glass placed in contact, so it has been proved that spermatozoids if placed upon one part of two surfaces of animal membrane applied to each other are in a short time found upon all parts of these surfaces. When the spermatozoids are in the uterus, the current resulting from the movements of the ciliated epithelium may cause their passage to the oviducts, and

their transmission to the abdominal end of the oviducts may again be by capillary action.

But laying aside these possible explanations, the probability is that the cause of the ascension of the spermatozoids is their own power of movement. Discharged in vast numbers in the vagina, they move in various directions; some enter the mouth of the womb, and finding there an alkaline mucus which facilitates and quickens their motility they pass into the cavity; thence several may enter the oviducts, and the probability is that one of the many will come in contact with the liberated ovule, without supposing that a special instinct guides its course. In all cases some time intervenes between coition and conception, between insemination and impregnation; this interval must be some hours, and it may be, as illustrated by the fecundation of the hen's egg twelve days before it is laid, several days. Hence the assertion made by some women, and accepted by a few obstetricians, that a peculiarly pleasurable sensation attends fruitful intercourse, is to be rejected. The intercourse may be with cruel violence, or the woman may be paralyzed by fear, or submit with indifference, or even with loathing and disgust; she may be in profound sleep, drugged, or anæsthetized; or, finally, artificial introduction of the seminal fluid into the uterine cavity may be done, yet in all these instances fecundation may result. In these supposed cases pleasure was impossible, and in some both mental and physical suffering and pain were present. The role of woman in copulation is passive; the probability is her pleasure cannot promote nor her pain prevent conception.

The Combination of Male and Female Elements.—It has been held that the spermatozoids after reaching the ovule were dissolved, then by osmosis penetrated its walls molecule by molecule, and the development of the ovule resulted; it was vivified by a sort of spermatic bath, and the richer the bath was in dissolved spermatozoids, the more certain would be impregnation. Another equally improbable explanation was that several spermatozoids entered the ovule, the greater the number entering the more certain the fecundation, and then were disintegrated, and were mingled with the yelk. But the more recent studies of fecundation in some of the inferior animals render it in the highest degree probable, and it is quite rational too, that in all cases only a single spermatozoid is concerned in normal impregnation.

Certain changes occur in the ovule independently of impregnation. The germinal vesicle moves toward the periphery of the ovule, and from the vesicle there is formed a cell, which first presents as a bud-like process projecting from the surface of the ovule, then the part nearest the free surface of the ovule becomes constricted, and separation follows; this process is repeated once, or oftener, and the bodies thus originating from the germinal vesicle, and ejected from the ovule, are called polar cells or globules. The formation of the polar cells[1]

[1] The apparently useless formation of polar globules has been given different explanations. One is that these globules are ejected from the ovule in order to secure space for the segementation of the vitellus. Another is, that they testify to a descent from ancestral forms having a lower organization, in which the discharge of the globules plays an important part, as in the parthenogenesis of bees, etc. Balfour suggests as one of the reasons

may occur while the ovule is still in the ovary, but more frequently afterward; they may precede or follow impregnation. These statements have been drawn from observation of the ova of some of the inferior animals; as remarked by Balfour, it is very possible, not to say probable, that such changes are universal in the animal kingdom, but the present state of our knowledge does not justify us in saying so.

It is generally held that the germinal vesicle is not entirely cast out in the form of polar globules, but a portion remaining in the ovule forms the female pronucleus, which combines with the male pronucleus. The latter is believed to be formed by the head alone of the spermatozoid. The entrance of the male element into the female is provided for in some fish by a minute opening, called a micropyle, in the covering of the ovule; this opening is so small that only one spermatozoid can enter at a time. But the ova of the mammiferæ show no such investment. Duval remarks that it is now proved that a great number of ovules at the time fecundation occurs are simply encircled by a pellucid zone—that is to say, a layer more dense, and having a special appearance, but which in a normal state is always fluid and permeable. Fol, of Geneva, states that putting in contact with an ovule liquids containing vibrions, the latter passed through this pellucid layer, and were found in the yelk; still more, then, this zone is permeable by the spermatozoid.

The vitelline membrane is a secondary formation, and is not found upon the unfecundated egg; but after the first spermatozoid has penetrated the vitellus, the ovule is rapidly encysted by condensation of its peripheral layer, a kind of catalytic phenomenon the nature of which is not clear. It is thus seen that nature provides for the entrance of one spermatozoid, but closes the door to a second, and if by mischance the latter enter, the result will be a double monster.

The part of the spermatozoid which enters the vitellus increases in size and is the male pronucleus. The male moves toward the female pronucleus, which occupies the centre of the ovule; the latter in some cases has been observed to lose its spherical form and become crescent-shaped, so as to receive in its concavity the male pronucleus. After the fusion of the two pronuclei there is but a single nucleus, in which are initiated all the changes which result in the formation of a new being. Balfour describes the act of impregnation as the fusion of the ovum and the spermatozoid, and the most important feature in the act appears to be the fusion of a male and of a female nucleus. This is brought in still greater prominence by the fact that the female pronucleus is the metamorphosed head of the spermatozoid, which contains part of the nucleus of the primitive spermatic cell, and the

for the ovule having this function, the prevention of parthenogenesis. It is the final act of the ovule; unaided it can do nothing more "There is but little doubt that the ovum is potentially capable of developing *by itself* into a fresh individual, and therefore unless the absence of sexual differentiation were very injurious to the vigor of the progeny, parthenogenesis would certainly be a very constant occurrence; and on the analogy of the arrangement in plants to prevent self-fertilization, we might expect to find some contrivance both in animals and in plants to prevent the ovum developing by itself without fertilization. If my view about the polar cells is correct, the formation of these bodies functions as such a contrivance." (Balfour, Comparative Embryology.)

female pronucleus is the product of a primordial ovum. The spermatic cells originate in primordial cells, which cannot be distinguished from primordial ova, and thus the impregnated ovule results from the fusion of morphologically similar parts in the two sexes.

Time of Conception.—This cannot be certainly known, but the time when coition is most likely to be followed by impregnation is well known by the public as well as by physicians. The "conception curve" given by Foektistow[1] shows that conception is most liable to occur from coition in the first seven days following menstruation; the first day after the flow ceases has the highest percentage, and from this time the latter gradually declines. Hensen's conclusions are in accordance. But while conception is very improbable during a certain portion of the menstrual interval, it cannot be affirmed that it is impossible at any time.

Fate of the Spermatozoids not concerned in Impregnation.—As has been previously stated, it is almost certain that in human beings, as has been proved to be the fact in some of the inferior animals, only one spermatozoid is concerned in impregnation, and the question naturally arises what becomes of the multitude who have no part in this process, a number greater than Penelope's suitors during the long absence of Ulysses. Is it not possible that they may permanently modify the organism or the undeveloped ovules so that the product of a future pregnancy, though by another father, may be affected ?[2] The heredity of influence is that observed in the children born by a widow who remarries, these children resembling morally and physically the first husband. Occasional instances of such heredity occurs, and, it is claimed that in reproduction in the inferior animals, the first sire may materially modify the offspring of subsequent sires. Admitting the fact, possibly the factors in such modification may be the original spermatozoids that did not contribute to the first conception. But the question eludes investigation.

Production of Sex.—The essential causes of the differences of sex are not known. By Sadler and Hofacker the following conclusions were drawn as to the influence of age: If the husband be younger than the wife, there are as many boys as girls; if both are of the same age, there are 1029 boys to 1000 girls; if the husband is older, 1057 boys to 1000 girls. These laws are not to be accepted as conclusive. The normal proportion between female and male births is 100 to 105 or 106. But in the case of illegitimate births, the proportion is reversed, at least for the children first born, that is to say in such births females are more numerous than males. The proportion of male children to females is slightly greater in the country than in the city. The chances of the young wife having at her first pregnancy a boy are at their maximum, while those of the matron near the close of her repro-

[1] Op. cit.

[2] This is by some called *infection* of the mother. Doléris regards it as without positive proofs. He also quotes Colin as saying: If the male can indeed, in fecundating the female, exercise an action upon the eggs contained in the ovary, and which contribute to subsequent gestations, this influence is very difficult to conceive. Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxxiv.

ductive life are at their minimum. Swedish statistics prove that in the nobility, the age of the husband being greater than that of the wife, there are only 98.3 male to 100 female births; this reverses one of the rules given by Sadler, according to which there ought to be a great preponderance of male births. Bertillon states that the influence of the ages of the parents upon the proportion of the sexes, if it exists, may be neutralized by the inherent qualities appertaining to the parents.

The law of Thury that the incompletely developed ovule produces a female, and the completely developed one a male, has not been verified in the human race. It is claimed with apparent reason by Fürst and others that each sex tends to produce the opposite; each one at the time of greatest sexual vigor is least apt to continue his or her own sex, most apt to produce the opposite.[1] The probability is that we will never know nature's secret in determining sex, and that "the production of the sexes at will" will always remain a dream if not a foolish delusion.

Time of Year most Favorable to Conception.—In the subjoined table[2] comprising the births in Philadelphia each month during five years, it is seen that the greatest number of births occurred first in August, second in January, third in December. Hence the three months in which the greatest number of conceptions took place were, in order, November, April, and March. The smallest number of births was in April, and therefore the fewest conceptions occur in July.

	1880	1881	1882	1883	1884	Totals.
January	1709	1647	1762	1839	1936	8893
February	1638	1515	1671	1803	1832	8449
March	1594	1504	1628	1768	1856	8350
April	1405	1386	1538	1572	1577	7478
May	1486	1437	1435	1506	1706	7570
June	1486	1403	1435	1682	1868	7874
July	1588	1601	1641	1945	1878	8653
August	1815	1554	1767	1874	1958	8968
September	1629	1532	1883	1849	1937	8830
October	1682	1502	1754	1833	1915	8686
November	1621	1488	1784	1748	1779	8428
December	1735	1585	1800	1818	1918	8856
Totals	19,388	18,154	20,098	21,237	22,160	

The following is an abstract of statements made by Ploss[3] in regard to the influence of the seasons upon conception. The fact that there is an increase in the number of conceptions at certain times of the year, does not indicate that there is a greater ability on the part of the female to conceive at these times, or any change in the physiological condition of the female sexual organs. The influence of the seasons upon the male are also to be taken into consideration. Villermé found that the maximum of conceptions in Europe occurs in May and June, and he attributed it to the influence of spring. In order to justify this opinion he extended his observations to those parts of the world where, while the seasons follow in the same order, they occur at different times, *e. g.*, Buenos Ayres, and found the results the same. The times when marriages are most, and those when they are least frequent, have no apparent influence upon the

[1] Arch. f. Gynäkol. 1886.
[2] I am indebted to my friend, Dr. Willian E. Ashton, for the preparation of this table.
[3] Op. cit.

number of conceptions according to the season of the year. On the other hand, the periods of comparative rest, of hard labor, and scarcity of food have a marked influence. The number of conceptions is lowered by the harvesting season, scarcity of food, and by the strict observance of religious fasts, as Lent. "These conditions which strengthen us, increase our fertility, and those which weaken or depress us, or especially such as undermine the health, lessen it, though fertility is by no means governed by health alone."

Wäppenhaus's conclusions from his studies of the birth-rate in Sardinia, Belgium, the Netherlands, Saxony, Sweden, and Chili, are as follows: The maximum of conceptions occurs in May and June. The cause is the vivifying influence of spring, aided by the habits and customs of the church in all Catholic countries. There is a gradual decrease to the minimum, which is in September and October. The cause is in the increased heat of summer, and in the epidemic diseases resulting therefrom, aided by the hard work of harvest. In Sweden this maximum is in January. The cause is found in social customs and in the religion. The dissipations incident to the period of Carnival, and the strict observance of Lent lessen the maximum in Catholic countries.

In Italy the maximum differs in the north and in the south. In the latter it is in April, but in the former in July.

Illegitimate conceptions are more under the influence of physical conditions, *e. g.*, the seasons, than are legitimate conceptions. In western Europe the greatest number of illegitimate offspring are conceived in spring and in summer, the fewest in fall and winter; the difference is much less marked in the conceptions occurring in the married.

In Russia the greatest number of conceptions occur in April and in January.

Changes in the Fecundated Ovule.—The first of these changes is segmentation, or cleavage, the sphere dividing into two spheres. The process of division occurs in the nucleus first, and is followed by that of the vitelline mass surrounding the two newly formed nuclei, and each new sphere has thus a part of the original nucleus. These spheres again similarly divide, so that the two become four, which also divide and eight are formed; subdivision after subdivision occurs until the entire vitelline mass has been converted into a number of minute spheres which from their supposed resemblance to a mulberry have been called the muriform body.

These spheres are unequal in size, and fulfill different purposes in the process of organization. The larger and more transparent are called *epiblastic* from επι, upon, and βλαστος, germ; the smaller *hypoblastic*, from υπο, under, and βλαστος, germ. The segmentation, too, is not simultaneous in the spheres after eight are formed, but begins in the epiblastic spheres; a cup-shaped cavity is formed by them in which the hypoblastic spheres are placed, making a solid central mass.

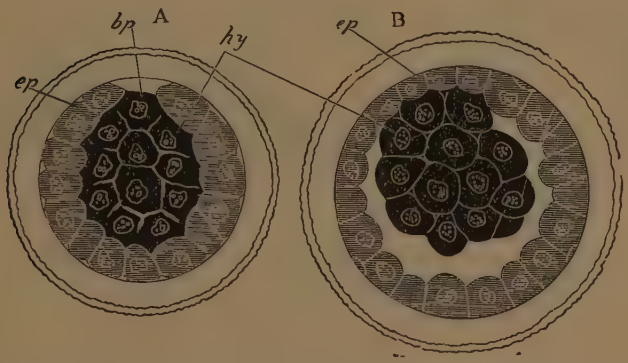
It will be seen at the end of segmentation[1] that the epiblast cells are somewhat the smaller, that they are clear, and irregularly cubical in form; the hypoblast cells, on the other hand, are polygonal in form and granular and opaque in appearance. *A*, Fig. 62, shows an opening in the epiblast covering of the hypoblast cells; this opening is called

[1] Balfour.

the blastopore; it, however, is soon closed, as represented in *B*, Fig. 62, by the growth of epiblast cells.

After the segmentation and arrangement of the cells, the ovum passes into the uterus; this is supposed to occur eight or ten days after fecundation, and the ovum is then probably the size of a very small pea.

FIG. 62.



OPTICAL SECTION OF A RABBIT'S OVUM AT TWO STAGES CLOSELY FOLLOWING SEGMENTATION.—*ep.* epiblast; *hy.* primary hypoblast; *bp.* van Beneden's blastopore. (After E. van Beneden.)

Formation of the Deciduous Membranes.—Before tracing the further development of the ovum, it is advisable to refer to the changes in the uterine mucous membrane incident to the beginning of pregnancy, the fitting up of the interior of the house in which the new being is to dwell during the many months of intra-uterine development.

It was formerly taught by John Hunter and others that the stimulus of pregnancy produced an inflammatory exudate upon the uterine mucous membrane, and thus a closed sac occupied the uterine cavity. The fecundated ovule could only enter the uterus by pushing before it that part of this new membrane which was in relation with the uterus in the immediate vicinity of the oviduct through which it came, and the mouth of which it covered; the portion thus pushed away, therefore became a reflected membrane, and hence was called the *membrana reflexa*, while that which remained adherent to the remaining portion of the uterine mucous membrane was a true membrane, unchanged in its relations, and received the designation of *membrana vera*. Finally, the surface to which the *reflexa* had been attached was left bare, but a new exudate covered it, making a membrane which, because of its *late* formation, was called the *membrana serotina*. As these membranes were discharged with the ovum at the end of pregnancy, they were called deciduous or caducous.

Hunter's theory was accepted as explaining the fact that in abortion the unbroken ovum showed a complete investment from the uterine mucous membrane. While the theory has been rejected, the names of the deciduous membranes are retained, and, therefore, an explanation of the origin of these names was necessary.

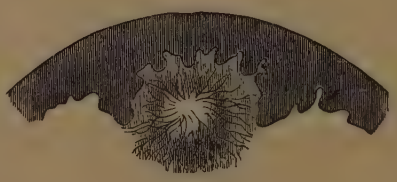
The deciduous membranes originate as follows: The uterine mucous

membrane is swelled and thrown into folds; the ovum is thus stopped from descent after it enters the uterine cavity, and lodges in one of the intervals between these folds; there is formed at its place of lodgment a cup-shaped cavity, a condition which is represented in Fig. 64.

Fig. 63.

Diagram showing Hunter's Theory of the Deciduous Membranes.—*a*. Decidua vera. *b*. Decidua reflexa.

Fig. 64.



First Stage of Formation of Deciduæ.

The mucous membrane upon which the ovum rests, the membrane which in the Hunterian theory was the *serotina*, is now called from its final purpose the placental decidua. The borders of the cup-like cavity grow higher, extend towards a common centre, and finally meet and unite over the ovum, forming a complete covering; thus that which was called the decidua reflexa, but now appropriately termed the decidua of the ovule or ovular decidua, is formed.

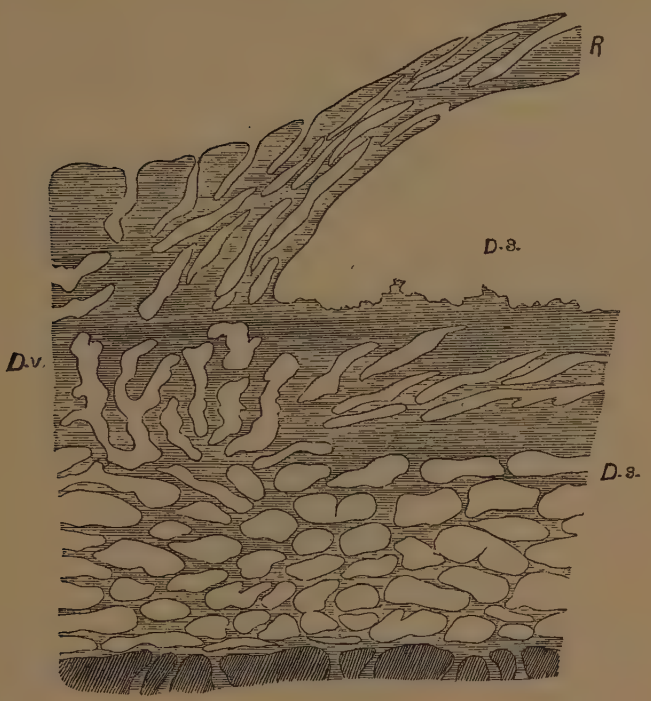
Fig. 65.

Formation of Deciduæ Completed. *b*. Decidua vera. *a* Decidua reflexa. *c*. Decidua serotina.

The third deciduous membrane, *decidua vera*, covers all the internal uterine surface, except that upon which the ovum rests; it is necessarily continuous with the other membranes; it was formerly called, as has been stated, the decidua vera, but from its relation to the uterine wall it may be appropriately termed the uterine decidua.

Subsequent changes in the deciduæ will be considered in connection with the formation of the placenta, and with the uterine changes caused by pregnancy, and the history of the development of the ovum will be now resumed.

FIG. 66.



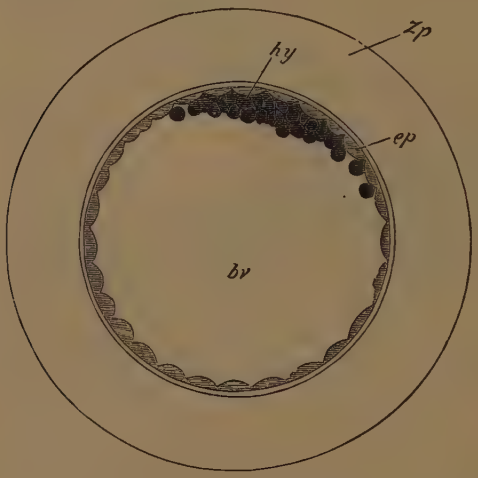
SECTION THROUGH THE MATERNAL MEMBRANES IN THE SECOND MONTH OF PREGNANCY.—20 X. *Dv.* Decidua vera. *Ds.* Decidua serotina. *R.* Decidua reflexa. The ovum has been removed from its point of fixation between *R* and *Ds.*

The Blastodermic Vesicle.—We have found the segmentation of the vitellus and the vitelline nucleus the first step in developmental changes; subsequent segmentations occurred, but these were unequal and not simultaneous, and the products were two kinds of cells differing in number, in form, in size, in arrangement, and as to transparency. The next step after the inclosure of the hypoblast by the epiblast cells is the formation of the blastodermic vesicle.

A fissure now appears between the epiblast and hypoblast cells, and this increasing cavity separates the two at all points, except at that corresponding with the position which was occupied by the blastopore. There results a vesicle whose wall, inclosed by the vitelline membrane, is formed by epiblast cells with the hypoblast cells accumulated upon a part of its interior surface, and this is called the blastodermic vesicle, or the blastoderm. In the subjoined diagram of the rabbit's ovum, between seventy and ninety hours after impregnation, it will be seen that the vitelline membrane, membrana pellucida, is external, then the flattened epiblast cells completely line it, while the hypoblast cells are arranged in a lens-shaped mass within the epiblastic investment.

The growth of the vesicle is very rapid, and the hypoblast losing its lens-shape is flattened and extended upon the inner side of the epi-

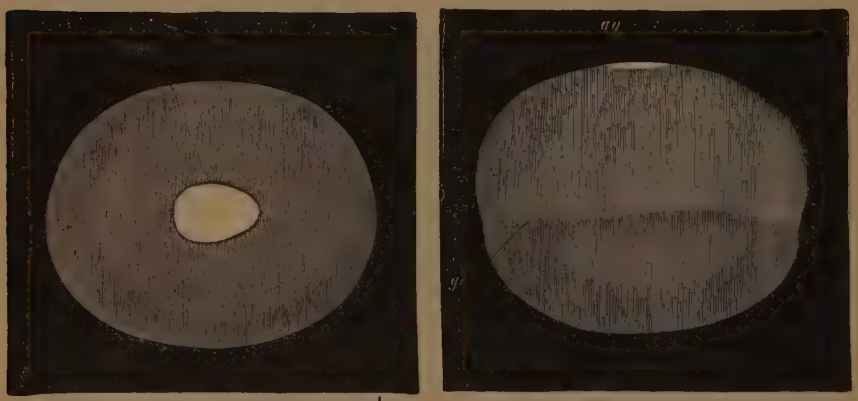
FIG. 67.



b v. Cavity of the blastodermic vesicle, or yelk sac. *e p.* Epiblast. *h y.* Primitive hypoblast. *z p.* Mucous envelope, zona pellucida. (After E. Van Beneden.)

blast. "The central part, however, remains thicker, and is constituted of two rows of cells, while the peripheral part, the outer boundary of

FIG. 68.

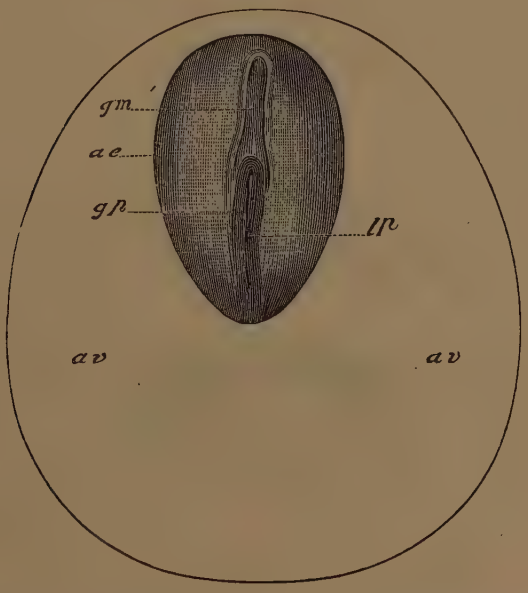


DIAGRAMMATIC VIEWS OF BLASTODERMIC VESICLE OF A RABBIT ON THE SEVENTH DAY.—In the left hand figure the vesicle is seen from above; in the right hand figure from the side. The white patch (*a g*) is the germinal area; and the slight constriction (*g e*) marks the limit to which the hypoblast has extended.

which is irregular, is formed of an imperfect layer of amœboid cells, which continually spread further and further within the epiblast. The central thickening of the hypoblast forms an opaque circular spot on

the blastoderm, which constitutes the commencement of the embryonic area." Next a third layer intervenes, the mesoblast, from μέσος, middle, and βλαστος, germ; the formation of the mesoblastic layer is not perfectly understood, but probably it originates in part from each of the primitive layers. From these layers, epiblast, hypoblast, and mesoblast, all the parts of the fœtus are formed. The epiblast gives origin to the nervous system, and also contributes to the formation of the organs of special sense. From the hypoblast are derived the epithelium of the digestive canal, of the trachea, bronchial tubes, and air-cells; the cylindrical epithelium of the ducts of the liver; pancreas, thyroid body, and other glands of the alimentary canal; the hepatic cells constituting the parenchyma of the liver; the secreting cells of the pancreas and other glands are also derived from the hypoblast. The muscles, bones, connective tissue, arteries, veins, lymphatics and capillaries, and the urinary and generative organs, are formed from the mesoblast.

FIG. 69.



SHOWING THE EMBRYONIC AREA WITH PRIMITIVE STREAK AND PRIMITIVE GROOVE OF THE OVUM (RABBIT) AT THE SEVENTH DAY.—*ae.* Embryonic area. *gp.* Primitive streak, or groove *av.* Vascular area. *gm.* Medullary groove. *lp.* Primitive line.

The embryonic area, *area germinativa*, becomes oval; it is composed of epiblast, hypoblast, and mesoblast. Following the pyriform appearance of the embryonic area there is found at its posterior and narrower end the primitive line or streak; a little afterwards the primitive line is seen to mark the middle of a straight, shallow groove, called the primitive groove. The next step is the formation of the axial or medullary groove upon the upper part of the embryonic area; upon each side of the groove are folds, the medullary folds, "which

meet in front but diverge behind, and inclose between them the foremost end of the primitive streak; the groove is converted into a closed tube, the neural canal, which is the beginning of the central nervous system."

The Embryo.—The embryo, from Εμβρυος, that which grows in another's body, as first presenting form, results from a folding inward of a portion of the blastodermic vesicle, and presents somewhat the shape of a boat; the extremities, however, are unequal in size, the larger is called the cephalic or head end, while the smaller is the caudal or tail end. This infolding of the blastodermic vesicle destroys its spherical form, and a constriction divides it into two parts, the smaller of which is embryonic, while the larger is called the yelk sack or the umbilical vesicle; an opening corresponding with the umbilicus offers free communication between the two.

Formation of the Amnion.—The development of the uterine deciduous membranes which furnish the external investment of the ovum has been given, and there will be now considered the origin of the internal membrane of the embryonic sac.

At both the cephalic and the caudal end of the embryo the mesoblast is divided into a splanchnic and a somatic layer; then a fold com-

FIG. 70.

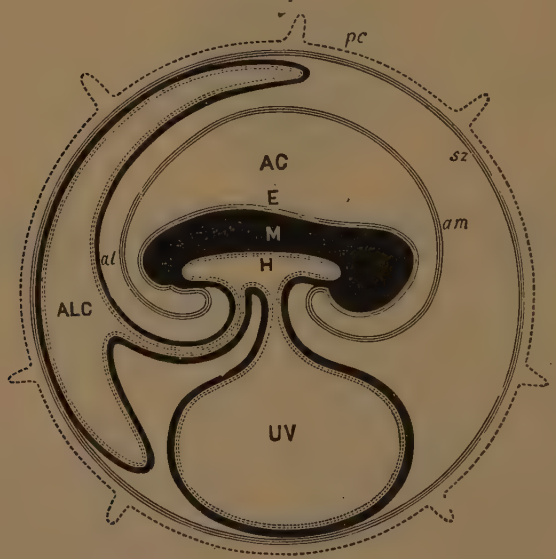


DIAGRAM OF THE FŒTAL MEMBRANES OF A MAMMAL.—(Structures which either are or have been at an earlier period of development continuous with each other are represented by the same character of shading.)—*pc.* Zona with villi. *sz.* Subzonal membrane. *E.* Epiblast of embryo. *am.* Amnion. *A C.* Amniotic cavity. *M* Mesoblast of embryo. *H.* Hypoblast of embryo. *UV.* Umbilical vesicle. *al.* Allantois. *A L C.* Allantoic cavity.

posed of the somatic mesoblast and epiblast begins to rise up from and grow over these extremities, and also a fold from each side; the cephalic fold appears first. These double folds are the beginning of a membrane called the amnion, from ἀμνος, a lamb, which will be described

hereafter. The caudal, cephalic, and lateral folds finally meet and unite, and thus form a complete sac. As is seen in Fig. 70, each fold is double; the inner layers form what is called the true amnion, and the outer the false. The false amnion with the epiblast from the umbilical vesicle forms the subzonal membrane.

The Allantois.—As the embryo grows and the amnion is developed, the umbilical vesicle lessens, but another vesicle is formed, the allantois or allantoid, from αλλας, sausage, and εἰδος, likeness, from its fancied resemblance to a sausage.

The origin of the allantoid has been differently stated by different observers. By some this structure is derived from the terminal portion of the intestine, by others from the Wolffian bodies, by others directly from the walls of the pelvic cavity by an expansion from the mesoblast and hypoblast. Kölliker describes the allantoid in the embryo of the rabbit as appearing under the form of a hollow body in relation with the posterior intestine, lined within by intestinal epithelium, and covered externally by a prolongation of the fibro-intestinal layer, and thus formed makes a projection in the free space between the amnion, the serous envelope, and the vitelline sac or umbilical vesicle.

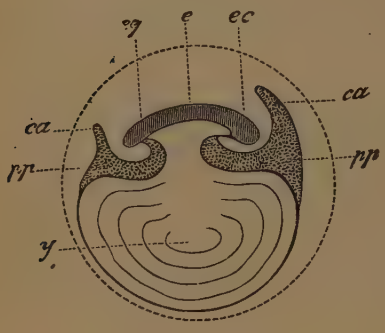
A part of the allantoid protrudes from the embryo, and a constriction separates it from the intra-embryonic portion; the latter becomes in a later stage of development the urinary bladder, while the isthmus connecting the two is the urachus, and at birth is a fibrous cord uniting the summit of the bladder to the umbilicus. The extra-embryonic portion is at first spherical, but projecting to the subzonal membrane, it becomes flattened and spread out like an umbrella, lining the membrane throughout nearly or quite all its extent. The external of the layers from which the allantoid is formed is mesoblastic in its origin; this layer fuses with the subzonal membrane, and from the fusion the second of the investing membranes of the fœtus is formed. The allantoid, especially that part contributing to the formation of the chorion, becomes very vascular; the blood is brought to it by two arteries, called the allantoic, which arise from the terminal bifurcations of the aorta, and returned by one, or in some cases two veins, which joins the vitelline veins from the yelk sac. The vessels of the allantoid penetrate into the chorial villi with which they are in relation. The sac of the allantoid contains a fluid which is at first colorless, but afterwards is yellow or amber-colored; it is alkaline, and contains chloride of sodium, albumen, sugar, urea and its derivatives, and a substance called allantoidine; it has in a high degree the property of converting fats into an emulsion. The chief use of the allantoid in development seems to be in conducting the allantoic, afterward the umbilical arteries, to that part of the chorion where the placenta is formed.

Fœtal Appendages.—These are the membranes forming the sac inclosing the fœtus, consisting of the deciduæ, that of the ovum and of the uterus—the *reflexa* and the *vera*, according to John Hunter's theory—which become united so as to form a single structure, the chorion and the amnion—the placenta and the umbilical cord.

The Amnion.—This is the most internal of the membranes, and

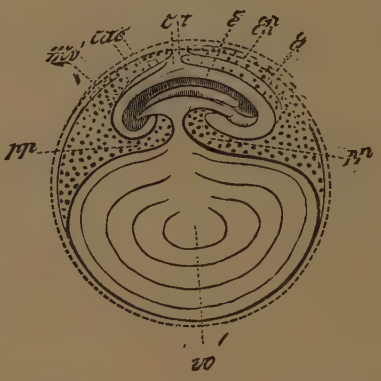
forms a sac completely surrounding the fœtus. The origin of the amnion has been given, and its further development can be traced in connection with the subjoined diagrams.

FIG. 71.



e. Embryo. *ec*. Cephalic extremity. *eg*. Caudal extremity. *ca*. Amniotic hood. *pp*. Pleuro-peritoneal cavity. *y*. Umbilical vesicle.

FIG. 72.



e. Embryo. *a*. Amnion. *oa*. Amniotic umbilicus. *cac*. Amnio-chorial cavity. *pp*. Pleuro-peritoneal cavity. *ch*. Chorion. *mv*. Vitelline membrane. *vo*. Umbilical vesicle.

In the first illustration the cephalic and caudal folds are seen projecting over the back of the embryo; the former fold, first in formation, is somewhat larger than the other. In the second figure the folds have approached very near to each other, and the intervening space is so small that it is called the amniotic umbilicus. Figure 6 shows them united. It is also seen, as previously stated, that each fold is composed of two layers, and that the completed amnion has two walls, one internal and the other external. The former is separated throughout almost its entire extent from the fœtus by the fluid called the liquor amnii, but is continuous with it at the umbilicus; this is the permanent, or true amnion. The external layer, or false amnion, is applied to the internal face of the vitelline membrane. The internal or true amnion covers the fœtal face of the placenta, and also the umbilical cord, furnishing a complete sheath to the latter. It is thin and transparent, and is composed of two layers, the internal, which is epithelial, and the external, which is fibrous. It is without nerves, but comparatively recent inves-

FIG. 73.

COMPLETION OF THE AMNION.—*u*. Umbilical vesicle. *p*. Pedicle of the allantoid. *a*. Amnionic cavity.

tigations seem to prove the presence of bloodvessels; these are called *vasa propria*. From the middle of pregnancy the amnion is applied directly to the chorion, and united to it by a gelatinous layer of tissue, the tunica media of Bischoff; it is also called the vitriform body of Velpeau; it adheres more intimately to the amnion than it does to the chorion.

Liquor Amnii.—The amniotic fluid is an alkaline, serous, clear liquid, having a specific gravity of 1007–1011, and an odor somewhat like that of fresh meat. Towards the end of pregnancy it may be opaque, whitish, or greenish; in women who work in tobacco factories it may be discolored and have a very offensive odor; it may be dark green or brown from the presence of meconium, or reddish in case the fœtus has been macerated. It[1] contains from ½–2 per cent. of fixed solids; among them are mucin, globuline, a vitelline-like body, some grape sugar, urea, ammonium carbonate, very probably derived from the decomposition of urea, sometimes lactic acid and kreatinin, calcic sulphate and phosphate, and common salt. It also contains sebaceous matter, lanugo, epidermic scales, and epithelium from the kidneys and the bladder. The quantity of amniotic liquor, small at first, increases until at the middle of pregnancy its weight is equal to that of the fœtus, while at the end of pregnancy the latter weighs five or six times as much as this fluid. Generally the weight of the amniotic liquor is, at the end of pregnancy, inversely proportionate to that of the fœtus. The weight at the middle of pregnancy is stated by Landois to be 1–1.5 kilogram, 2.2–3.3 lbs., and at the end only about 0.5 kilogram.

Three opinions are held as to the source of this fluid: First, its origin is maternal; second, fœtal, and third it is derived from both the mother and the fœtus. The last is that which is generally accepted. Landois, however, holds that it is of fœtal origin because of its occurrence in birds, and suggests that it may be a transudation through the fœtal membranes. The experiments of Zuntz[2] prove that it must in part be derived from the mother. In the latter half of pregnancy the urine of the fœtus forms part of it.

Uses of the Amniotic Liquor.—During pregnancy the amniotic liquor preserves the fœtus and the vessels of the cord and placenta from mechanical injuries, facilitates the movements of the fœtus, and permits them to occur with less inconvenience or suffering to the mother; gives space for the development of the fœtus, and promotes the equable enlargement of the uterus. During labor it protects the fœtus and cord from injurious pressure, and furnishes before rupture of the membrane a hydrostatic dilator for the os uteri, while after the rupture the escaping fluid lubricates the genital canal. Further, this liquid contri-

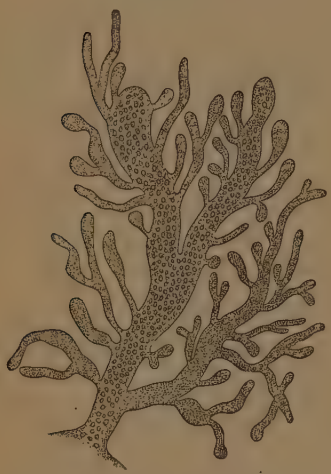
[1] Landois.

[2] "Zuntz, however, argues that since sodium sulphindigolate injected into the veins of the mother (rabbits) is readily found in the fluid of the amnion, but not in any part of the body of the fœtus (save a small quantity in the stomach, probably derived from amniotic fluid which had been swallowed), the fluid must be discharged from the maternal structures, and cannot, at all events, be regarded as wholly a secretion from the fœtus. The sulphindigolate also made its way into the amnion when the fœtus had been previously killed. The urea of the amniotic fluid may accordingly, in part at least, have escaped by diffusion from the blood of the mother." (Foster's Physiology, third edition, p. 624.)

butes to the nutrition of the fœtus. Preyer states[1] that in the fœtus the tissues contain more water than the blood, and it must, therefore, get water from some other source than the blood, *i. e.*, from the amniotic fluid. The fœtus swallows large quantities of amniotic fluid, which is absorbed by blood and chyle vessels from the intestinal tract; in the early stages of development much amniotic fluid enters through the skin of the embryo.

The Chorion.—From χοριον, the membrane that incloses the fœtus in the womb. This membrane is external to the amnion, internal to the decidua. At the beginning of intra-uterine life the external covering of the ovum, the membrana pellucida, or vitelline membrane, is transparent and smooth; but in the second week its surface presents numerous projections called villi, which are at first solid, and this is known as the primitive chorion. The permanent chorion is formed by the junction of the allantoid and subzonal membranes, followed about the fourth week by bloodvessels which begin to penetrate into the chorial villi, and these now hollowed out become sheaths for the vessels; an artery enters each villus, sends branches to all its branches or bud-like offshoots; capillaries connect with veins, and the latter unite in a single trunk which returns the blood to the umbilical veins.

FIG. 74.



COMPOUND VILLUS OF CHORION FROM A THREE MONTHS' FŒTUS. (Magnified 30 diameters.)

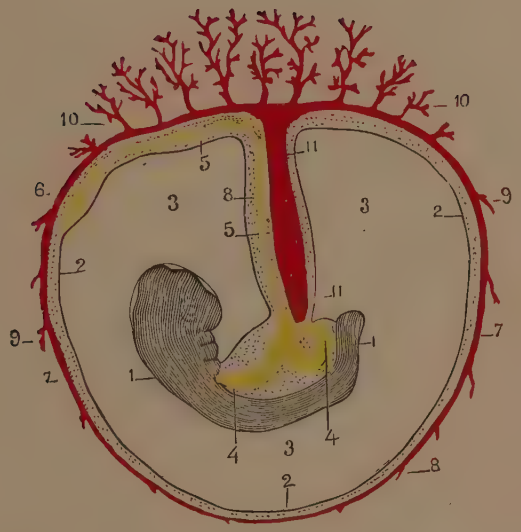
At first all the chorial villi, thus made vascular, hypertrophy, but this lasts only until the third month when those villi in relation with the decidua of the ovum, the decidua reflexa, atrophy, while those connected with the serotine decidua, or the placental decidua, become larger and more branched; the portion of the chorion to which the former belong is sometimes spoken of as the chorion leve or the smooth chorion, while the latter is called the chorion frondosum or leafy chorion. The chorion is thicker than the amnion, but is weaker; it is composed of two layers, one chiefly of connective tissue becoming fibrous in character at the end of pregnancy, and the other of pavement epithelium.

Doubtless the chorial villi even before they become vascular are concerned in the nutrition of the embryo, but the chief use of the chorion is in the formation of the placenta.

In the accompanying Plate, exhibiting the evolution of the placenta and of the umbilical cord, the atrophy of the larger number of the chorial villi, and the hypertrophy of others, those which contribute to the formation of the placenta, are well shown.

The Placenta.—This is also called the afterbirth. The name placenta from πλακοῦς, a flat cake, was first used to designate this organ as found

[1] Specielle Physiologie des Embryo.



EVOLUTION OF THE PLACENTA AND OF THE UMBILICAL CORD. From SAPPEY.

1, 1. Embryo.

2, 2, 2. Amnion.

3, 3, 3. Cavity of Amnion.

4, 4. Digestive Canal.

5, 5. Pedicle of the Umbilical Vesicle.

6, Umbilical Vesicle.

7, 7. Allantoid Vesicle.

8 Pedicle of the Allantois.

9, 9, 9. Chorial Villi beginning to atrophy.

10, 10. Villi in relation with the utero-placental decidua, which hypertrophy.

[*To face page 124.*

in the human female, by Realdus Colombus. In many of the inferior animals its form is very different from that signified by this name. The placenta is a fleshy, flattened mass, usually oval, but sometimes round or reniform. Its diameter is six to eight inches, fifteen to twenty centimetres; it is thickest at the insertion of the cord, varying from a little more than one-third to more than an inch, one to three centimetres, and thinnest at the margin, where its thickness is about one-fifth of an inch, five or six millimetres; it weighs at the end of pregnancy about eighteen ounces, or five hundred grams. Nevertheless there is great variation in the weight of the placenta; it may be only one-half that given, or may be twice as much; usually the weight is in direct proportion with that of the child. It presents two faces or surfaces, one internal or fœtal, and the other external, or maternal.

FIG. 75.

FŒTAL SURFACE OF THE PLACENTA.

The external, or uterine, surface of the placenta is dark-red, somewhat convex, rough, and uneven. It presents irregular fissures, incompletely dividing the organ into lobes; these fissures are partially bridged over and lined by a whitish membrane, the remains of the placental decidua, or the serotine decidua. The internal, or fœtal, surface of the placenta is smooth, slightly concave, and covered by the combined chorion and amnion, which thus forms its superficial layer; the attachment of the cord, and the larger division of its placental vessels are plainly seen. A large vein, called the circular or marginal sinus, is found at the border of the placenta. In some cases the placenta, instead of being a single mass, is composed of two parts, and is designated as placenta duplex; if composed of three parts, placenta

tripartita, and if of many separated lobes, placenta multiloba; if in addition to the usual placental mass there should be one or more dis-

FIG. 76.

MATERNAL SURFACE OF THE PLACENTA.

tinct and separate lobes, such additional placentæ are called subsidiary placentæ, or *placentæ succenturiatæ.*

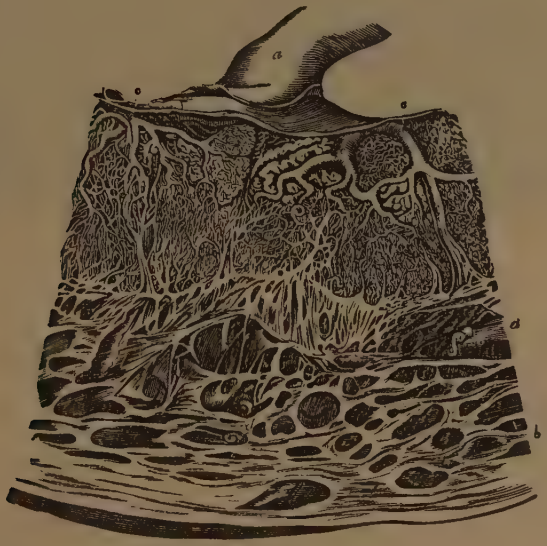
Situation of the Placenta.—The placenta is usually in the upper part of the uterus, upon the posterior or upon the anterior wall, in the vicinity of the opening of one of the oviducts. Attachment directly to the fundus—once regarded as frequent, if not the rule—is as rare as is that to the lower part of the uterus.[1] But, as remarked by Levret, "there is not a single part of the interior of the womb where the placenta may not take root." When the attachment is in the lower uterine segment the placenta is called prævia. After the delivery of the placenta the obstetrician can, by noticing the place of rupture of the membranes, judge, approximately at least, the place which the organ occupied in the womb.

It is not until in the third month of pregnancy that the placenta begins to be distinct, and it is not until the end of the month that its formation is completed. Part of this organ is of maternal, and part of

[1] Carmichael (Dublin Journal of Medical Science, 1839) having concluded, from his own examinations, that the usual site of the placenta was the lower part of the posterior uterine wall, caused so much controversy by the statement that he pleasantly remarked if he had anticipated such a result he would have left the placenta at the fundus.

fœtal origin, but these parts become so intimately united that they can only be separated in an early stage of its development. The placenta increases in weight until about the seventh month, when a regressive metamorphosis begins. The large villi of the chorion frondosum penetrate into the tissue of the decidua serotina; they do not enter the uterine glands, but into crypts formed by the hypertrophied uterine mucous membrane; the villi at first comparatively simple in form, not only greatly increase in size, but in number; they become complex, presenting many branches and offshoots. Goodsir has compared a placental tuft to a tree, consisting of a trunk with its primary and secondary branches. Meantime the villi of the chorion not in relation with the membrana serotina atrophy, and thus the chorion leve results. The villi of the chorion frondosum are formed of con-

FIG. 77.



SECTION OF A PORTION OF A FULLY-FORMED PLACENTA WITH THE PART OF THE UTERUS TO WHICH IT IS ATTACHED.—*a*. Umbilical cord. *b, b*. Section of uterus, showing the venous sinuses. *o, o*. Branches of the umbilical vessels. *d, d*. Curling arteries of the uterus.

nective tissue, and also, as stated by Goodsir and confirmed by subsequent observers, receive an epithelial covering from the hypertrophied serotine membrane. Each villus then is composed of connective tissue, of an epithelial covering, and of an artery and vein and connecting capillaries; this arrangement of the bloodvessels secures a closed vascular system. The placenta is composed of the hypertrophied villi of the chorion and of the serotine decidua, which grow into each other, mutually inter-penetrating, so that a single mass is formed.

After the interlocking of the chorial villi with the serotine membrane, blood-spaces or sinuses are found in the maternal portion of the placenta. This results according to some from great dilatation of the maternal capillaries, but according to others from disappearance of the walls of the capillaries, caused by the pressure of the growing chorial

villi. Into these spaces,[1] these blood-lakes, maternal arteries[2] enter, and from them veins pass. The terminal villi of the chorion float freely in the blood-sinuses, and thus the maternal is brought into such close relation with the fœtal blood that interchange of gases and nutritive materials can readily occur.

FIG. 78.

VERTICAL SECTION OF PLACENTA SHOWING RELATIONS OF MATERNAL AND FŒTAL BLOODVESSELS.—*a*, *a*. Chorion. *b*, *b*. Decidua. *c*, *c*, *c*, *c*. Orifices of uterine sinuses.

Uses of the Placenta.—The placenta is the organ of nutrition and of respiration for the fœtus. It was once held that there was a direct communication between the bloodvessels of the mother and the fœtus through the placenta, and thus the nutrition of the fœtus was explained. This view is disproved by the following facts: The maternal and the fœtal circulation are not isochronous; prior to the extension of the allantoid vessels to the periphery of the ovum the embryo had a circulation; if the fœtus die in labor when the mother perishes from hemorrhage, it dies from asphyxia, not from anemia. If the placenta be delivered with the fœtus, the circulation may continue several minutes, and there is no discharge of blood from the uterine surface of the placenta; if hemorrhage from the umbilical cord occur during labor, it does not affect the mother; the fœtal blood differs from the maternal blood in the form of the globules and in its composition. It is generally held that the interchange of gases and of nutritive elements between the maternal and the fœtal blood depends upon osmosis.[3] According

[1] Braxton Hicks (London Obstetrical Society's Transactions, vol. xiv.) denies the existence of placental sinuses, stating that from dissections early and late in pregnancy, there is no evidence of a sinus system.

[2] Delore (Annales de Gynécologie, 1874) contends that the entrance of maternal blood into the placenta is chiefly by the placental coronary, or circular sinus, which was first described by Meckel, and which sometimes has a diameter as large as the little finger.

[3] Ercolani taught that the fœtal portion of the placenta is vascular, or absorbent, and the maternal is glandular, or secretory. According to his theory the uterine juices, or milk,

to Marchal the endosmotic processes by which nutritive juices pass from the mother to the fœtus are facilitated by the greater blood pressure in the vessels of the former than in those of the latter. Experiments show that substances in solution may pass from the maternal to the fœtal blood. Among such substances are potassic iodide, salicylic acid, chloroform, chlorides, and turpentine. Many years ago Magendie detected the odor of camphor in the blood of the fœtus fifteen minutes after a solution of this substance had been injected into the maternal blood. Recent experiments, among others those of Dr. Pyle,[1] prove that some undissolved substances and bacteria may thus pass from the mother to the fœtus.

That the placenta is the organ of respiration for the fœtus is shown by the fact that the blood going to the placenta is dark, and that returning from it light; and that the only substitute for placental is pulmonary respiration. If the umbilical circulation be arrested the fœtus dies, and an autopsy proves the death was from asphyxia. In the placenta the fœtus exchanges[2] carbonic acid for oxygen, just as a fish through its gills receives oxygen from the water in which it swims. Bernard has shown that the placenta has a glycogenic function in the earlier months of fœtal life, prior to the formation of the liver. Foster suggests that the placental glycogen is of use, not for the fœtus, but for the nutrition and growth of the placental structures.

The Umbilical Cord.—The funis umbilicatus, or umbilical cord, receives its name from its twisted character. It is a cord essentially composed of bloodvessels, connecting the fœtus and the placenta. The pedicle of the allantoid, originally a constricted portion connecting the two portions of the allantoid, one within the embryo, the other external to it, is the beginning of the umbilical cord. At first, this pedicle or stalk had two veins as well as two arteries; one of the veins, however,

secreted by the epithelium of the latter, is absorbed by the chorial villi as chyle is absorbed by the intestinal villi. Balfour has given a qualified and partial support to this view, saying: "The walls of the crypts into which the villi are fitted also become highly vascular, and a nutritive fluid passes from the maternal vessels of the placenta to the fœtal vessels by a process of diffusion; while there is probably also a secretion by the epithelial lining of the walls of the crypts, which becomes absorbed by the vessels of the fœtal villi." Goodsir stated that the function of the placenta is not only that of a lung, but also of an intestinal tube, and that the internal cells of the villi absorb the matter secreted by the external cells. Kormann (Lehrbuch der Geburtshilfe, 1884) states that the nutritive material which the fœtus finds prepared in the placenta is the so-called uterine milk. According to Hoffman (Berlin Zeitschr. f. Geb. und Gyn., 1882), the purpose of the decidua in man as well as in animals is to furnish the necessary nourishment of the young. The decidua is a milk-secreting organ; this milk, which is secreted into the spaces which are gradually formed, and in which the placenta villi are placed, here is mixed with the simultaneously extravasated blood of the mother, and thus the fœtal nourishment is formed which is absorbed by the placental villi. Landois (Manual of Human Physiology) states: "Between the villi of the placenta there is a clear fluid which contains numerous small albuminous globules, and this fluid, which is abundant in the cow, is spoken of as the uterine milk. It seems to be formed by the breaking up of the decidual cells. It has been supposed to be nutritive in function." Stirling adds, that the maternal placenta, therefore, seems to be a secretory structure, while the fœtal part has an absorbing function. The uterine milk has been analyzed by Gamgee, who found that it contained fatty, albuminous and saline constituents, while sugar and casein were absent.

[1] Philadelphia Medical Times, June and July, 1884.

[2] According to Preyer, *op. cit.*, however, the transfer of carbonic acid from the fœtal to the maternal blood has not yet been proved experimentally.

atrophies, so that the cord has one vein and two arteries. Its formation begins at the end of the fourth week. At the middle of pregnancy its length is 5 to 8 inches, 13 to 21 centimetres, and its thickness about one-third of an inch; at the end of pregnancy its average length is about 20 inches, 50 centimetres, and its usual thickness that of a man's little finger. But the thickness may be much greater, equalling that of the thumb, or even exceeding it; if thus increased in size, it is commonly called a fat cord, while if its diameter is notably lessened, it is called a "lean cord." The length of the cord may be reduced to two inches, or increased to five or six times the average previously given. Its surface is smooth and shining from its amniotic investment; it presents a twisted or spiral aspect; the spirals, which begin to form in the third month, in two-thirds of cases, pass from left to right, commencing at the fœtal end of the cord; the number of spirals varies, in one case Meckel saw ninety-five. In most instances the vein is central, and the arteries turn round it; but in others, all three of the vessels are parallel, and turn round a fictitious axis. The amniotic sheath not only incloses the vein and arteries, but also a greater or less quantity of a gelatinous substance called Wharton's jelly. An unusual quantity of this material causes the cord to be very thick, and when it is tied after birth there is great liability to subsequent hemorrhages unless the tying be done very carefully so that complete constriction of the bloodvessels is secured. Wharton's jelly is a gelatinous-like connective tissue, consisting of branched corpuscles, lymphoid cells, some connective-tissue fibres, and elastic fibres. Accumulations of the jelly at particular parts of the cord, making decided prominences, cause what has been called false knots. But the absence of the jelly at any part of the cord does not prove that any of the vessels are impervious, or even that their capacity is lessened.[1] The

FIG. 79.

APPARENT CONSTRICTION OF BLOODVESSELS OF CORD, FROM ABSENCE OF WHARTON'S JELLY.

[1] The annexed illustration, Fig. 79, represents the appearance of the fœtal end of the umbilical cord in a large, seven months', still-born fœtus. The fœtus was brought to me as showing intra-uterine death from obstruction of the umbilical vessels; injections however proved that they were not only pervious, but of normal calibre. Dr. James Young (Transactions of the Edinburgh Obstetrical Society, Edinburgh, 1870) has reported a similar case where a dead fœtus at seven months was expelled, which showed the umbilical cord "greatly constricted near the abdomen;" but the just test of constriction involving the bloodvessels was not made.

vein has a thinner wall than the arteries; the diameter of its canal is greater than that of either artery, and increases as the vessel approaches the fœtus; from the inner surface of the vein crescent-shaped folds project, occluding two-thirds of the canal. The arteries widen in the course of the cord from the fœtus to the placenta, and have projecting broad folds. The vessels have well-developed muscular walls, and hence are very contractile.

The cord[1] has lymphatics; pale embryonic nerve-fibres may be followed for a short distance from the fœtus, but further on there are no nerves. The strength of the umbilical cord varies, and in some cases very slight traction causes its rupture.

FIG. 80.

BATTLEDORE PLACENTA.

True knots are sometimes found in the cord. They have been attributed to the violent movements of the fœtus, favored by excess of liquor amnii, and to similar movements of the mother; it is altogether exceptional for knots, however numerous, to interrupt the circulation.

[1] Kleinwächter.

The attachment of the cord to the placenta is usually at some point between the centre and the margin; the central insertion, though by some authorities claimed to be the rule, Naegle correctly stated is relatively rare; Levret made a similar statement. In some cases the cord is attached to the margin of the placenta, *insertio marginalis*, and the placenta is called battledore placenta; in one variety of marginal insertion the cord is attached first to the membranes, and the vessels subdivide before entering the substance of the placenta, *insertio velamentosa* (see Fig. 80).

CHAPTER II.

THE EMBRYO AND FŒTUS—DEVELOPMENT—ANATOMY AND PHYSIOLOGY OF THE FŒTUS.

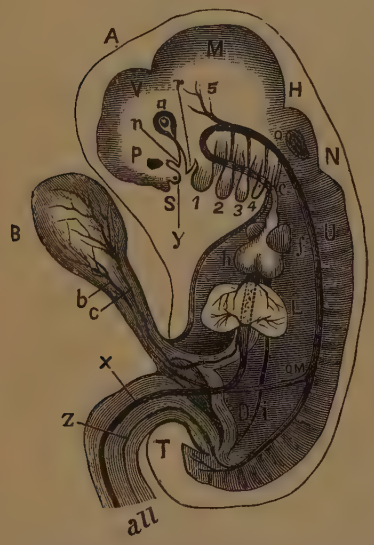
THE term fœtus, a Latin word for the young of mammiferæ while in the womb, is very commonly used as a synonym for embryo, the etymological signification of which has been stated. By many, however, the product of conception in the human female is called an embryo up to three months, and after that it is known as a fœtus. This distinction between the two words is plainly arbitrary, and as far as the term embryo is concerned, is disregarded in such words as embryotomy and embryulcia. Nevertheless, as the history of the first three months differs very materially from that of the subsequent six of intra-uterine life, since by the end of three months the placenta is completed, and the new being has assumed the human form, and subsequent changes are of growth and development rather than of the beginning of organs belonging to the organism, and essential for its existence or for its perpetuation, it is well to retain the arbitrary distinction between the words embryo and fœtus.

Naegle said that the obstetrician was more concerned with expedition than with fabrication—that is, with labor rather than with embryology; nevertheless, some study should be given to the latter. While, of course, embryology belongs to physiology, and is there fully presented, yet a general knowledge of the evolution of the new being from the fecundated ovule, "the dim speck of entity," belongs to obstetrics. Such knowledge is practically useful in that it enables the obstetrician to recognize how far development has progressed in a case of miscarriage; in some cases to ascertain the cause of miscarriage, whether the miscarriage be embryonic or fœtal, and also to explain the occurrence of certain deformities or so-called malformations, which are in most cases arrests of formation, failures of development. This knowledge, too, is of value in studying the physiology of the fœtus. In the following summary sketch of embryonic and fœtal development no attempt will be made to include all details and make a complete picture, but chiefly to present practical matters of interest and importance to the obstetrician.

First Month.—Recalling the statements made on page 117, as to the formation of the blastodermic vesicle, its separation into two portions, one embryonic, the other non-embryonic, and the appearance in the former of the medullary groove, with a fold or plate on each side, *laminæ dorsales*, the two subsequently uniting so that the groove is converted into a cylindrical canal—the medullary canal—it is seen that in the very beginning of organization the nervous system is placed

first. The heart, at first a tubular cavity, is seen by the end of the second week,[1] when the embryo is only one-eighteenth of an inch, two millimetres, long; by the middle of the third week it has taken an S form; and at the end of the fourth the different cavities are present, and the pericardium is formed. According to Preyer[2] it cannot be doubted that the heart commences to beat by the beginning of the third week. The visceral clefts, four in number, and arches are apparent by the twentieth day; the former are fissures found on each side of the cervical region, while the arches are thickenings of the lateral walls between the clefts.

FIG. 81.



SCHEME OF A HUMAN EMBRYO WITH THE VISCERAL ARCHES STILL PERSISTENT.—*A*. Amnion. *V*. Fore-brain *M*. Mid-brain. *H*. Hind brain. *N*. After brain. *U*. Primitive vertebræ. *a*. Eye. *p*. Nasal pits. *S*. Frontal process. *y*. Internal nasal process. *n*. External nasal process. *r*. Superior maxillary process of the first visceral arch. 1, 2, 3, and 4. The four visceral arches, with the visceral clefts between them. *o*. Auditory vesicle. *h*. Heart, with *e*, primitive aorta which divides into five aortic branches. *f*. Descending aorta. *o m*. Omphalo-mesenteric artery. *b*. The omphalo-mesenteric arteries on the umbilical vesicle. *c*. Omphalo-mesenteric vein. *L*. Liver with arriving and departing veins. *D*. Intestine. *i*. Inferior cava. *T*. Coccyx. *all*. Allantois, with *Z*, one umbilical artery; and *x*, an umbilical vein.

The extremities appear at the sides of the body as short unjointed stumps or projections in the third or fourth week. At the end of the fourth week the vertebral bodies and the nerve centres are quite distinct, the thorax and abdomen make a single cavity, the diaphragm not yet having been formed, and the heart is in the upper part of this cavity. The ovum is about the size of a pigeon's egg. The embryo is a grayish curved mass, the cephalic end is much larger than the caudal, and so great is the curvature that the two approach; the length of the embryo is about half an inch, or thirteen millimetres. The primitive intestine is a straight tube, proceeding from the head to the tail, and closed at each end. It was at first a gutter, and had free communication with the vitelline sac, but the gutter is covered over, and is converted into a cylindrical canal, and the vitelline duct, inserted at that point which at a later period corresponds to the lower part of the ileum, is obliterated. In some cases the duct remains pervious a short distance from the intestine,[3] making a blind tube, the so-called "true

[1] Aristotle stated that the heart could sometimes be seen in the bird's egg as early as the third day, no bigger than a point; it is compared to a bloody spot, and its beating is mentioned: from his description the *punctum saliens* of later writers is derived. The heart is the first of organs not, in formation, but in function, and in this sense is indeed *primum vivens*, though not in all cases *ultimum moriens*. Modern observers know that the heart in the chick is at the end of the first day "a small, bright-red, contracting point." Its development in mammals is much later.

[2] Op. cit.

[3] Landois.

intestinal diverticulum;" in very rare cases the duct may remain open to the umbilicus, forming a congenital fistula of the ileum, or it may give rise to cystic formations.

Kölliker divides the primitive intestine into three segments, the buccal, middle, and terminal. From the buccal, or initial segment, all the buccal cavity as far as the glosso-palatine arches is derived; the terminal portion furnishes the lower portion of the cloaca, while all the rest of the intestinal canal, and a notable part of the uro-genital system are derived from the middle segment. About the fourth week a depression upon the external tegument occurs at a point corresponding with the lower end of the terminal segment, with absorption of intervening tissue, and the anus is formed. A similar depression of the tegument occurs at a point corresponding with the position to be occupied by the mouth, and an opening is made which communicates with the buccal portion of the intestine; the mouth at first represents the space comprised between the first visceral arch and the most anterior part of the base of the cranium.

FIG. 82.

FORMATION OF ALIMENTARY CANAL.—*a b*. Commencement of amnion. *c c*. Intestine. *f*. Allantois. *g*. Umbilical vesicle. *x*. Dotted line showing the place of the formation of the œsophagus.

Second Month.—During this month the visceral clefts completely close except the first, which becomes the external auditory meatus, the cavity of the tympanum, and the Eustachian tube. "Should any of the other clefts remain open, a condition that is sometimes hereditary in some families, a cervical fistula results, and it may be formed either from without or within." Branchiogenic tumors and cysts depend upon the branchial arches, according to Volkmann.

The first visceral or branchial arch divides into two branches called the superior, and the inferior maxillary process; the two inferior maxillary processes, one from each side, grow toward each other, meet, and unite, making the lower margin of the mouth. So, too, the superior maxillary processes grow toward each other, but there intervenes the frontal process (*S*, Fig. 81), which unites with each of the others, and thus the upper boundary of the mouth is made, and the oral separated from the nasal opening. The separation between the nose and mouth within is made by the superior maxillary processes; from these the upper jaw, the nasal, and the intermaxillary process are produced; at the ninth week the hard palate is closed, upon it rests the septum of the nose, descending vertically from the frontal process. Different varieties of hare-lip result from arrest of descent of the frontal process, or from its failure to unite upon one, or upon both sides with the superior maxillary processes.

It not unseldom happens that if an infant be born with hare-lip the mother attributes the deformity to her having seen while she was pregnant some one, adult or child, similarly affected. But if she saw such an object subsequent to the second month of pregnancy, it is impossible that the fœtus could have been affected through her mind, for the deformity already existed.

Cleft palate arises from the failure of those portions of the superior maxillary processes concerned in the formation of the roof of the mouth to meet and unite. As is seen, the formation of the face chiefly results from the development of the first or maxillary arches. The second arch, *hyoid*, gives rise to the stapes, the pyramidal eminences, with the stapedius muscle, the styloid process of the temporal bone, the stylo-hyoid ligament, the smaller cornu of the hyoid bone, and the glosso-palatine arch. The third arch, *thyrohyoid*, forms the greater cornu and body of the hyoid bone and the pharyngo-palatine arch. The fourth arch gives rise to the thyroid cartilage.

In the second month the eyes appear first as two black points, one on each side of the head; the eyelids are not seen until the latter part of the month or the beginning of the next. The external ear appears as a slight projection at the seventh week. The development of the viscera causes the body to be less curved. The Wolffian bodies are notably lessened in size, but meantime the kidneys and supra-renal capsules are formed. The fingers and toes appear, but they are webbed. The formation of the external sexual organs begins, as previously stated, in the sixth week, but they present the same appearance in each sex; the testicles or the ovaries appear about the seventh week. At the end of the second month the ovum is about the size of a hen's egg, the embryo measures from one inch to one inch and a half, twenty-five and a half to thirty-seven millimetres, in length, and weighs about one drachm, four grams; the umbilical cord measures a little more than one inch, twenty-five and a half millimetres.

Third Month.—The fingers and toes have lost their webbed character, and the nails begin to be developed, appearing as fine membranes. The eyes are nearer, the ear well-formed, the walls of the body are thicker, and lose their transparency. The sex can be distinguished by the absence or presence of the uterus and vagina; the umbilical cord, inserted a little above the pubes, reaches a length of 2.7 inches, seven centimetres, and begins to take a spiral form. In the twelfth week the ovum is the size of a goose's egg, the embryo is from 2.7 to 3.5 inches, seven to nine centimetres, long, and weighs five drachms, twenty grams.

At about three months, points of ossification are found in all parts of the vertebral column. Ossific formation begins in the cervical vertebræ, then in the dorsal, finally in the lumbar, and in all the vertebræ it begins in the bodies before it does in the arches. Hence, spina bifida, which is a hernia of the spinal membranes through a cleft in their bony canal, is rarely anterior, and it is much more frequently lumbar than dorsal or cervical.

Fourth Month.—The fœtus is between six and seven inches, seventeen centimetres, long, and weighs nearly four ounces, three ounces and three-quarters, one hundred and twenty grams; the umbilicus is above

the lowest fourth of the linea alba, and the cord is seven and one-half inches, nineteen centimetres, long. The development of the female external sexual organs has been given on page 80; that of the male is the same up to a certain stage, but in the first half of the fourth month, in the male, the genital fissure closes, and the genital folds are united together to form the scrotum; the genital tubercle, which in the female forms the clitoris, becomes in the male the penis, and in the third month shows the formation of the glans. A very distinct *raphé* upon the penis and scrotum indicates the place of union of the two sides of the genital fissure. The prepuce is formed in the sixth month. The prostate, beginning in the third month, as a thickening at the point where the urethra and genital cord meet, can be plainly seen in the fourth month. If the sides of the genital fissure fail to unite, the condition is known as hypospadias.

A slight down-like growth of hair, lanugo, appears on the body, and a few hairs upon the head; meconium is found in the intestine, and feeble movements of the limbs occur. A fœtus born at four months may live some hours; no respiratory movement is made, but the pulsation of the heart and that of the umbilical cord are present; Cazeaux observed an instance where life continued four hours.

Fifth Month.—At five months the fœtus is about ten inches, 25 to 27 centimetres, long, and weighs eight to nine ounces; the average is 273 grams; the umbilical cord is about twelve inches, or 31 centimetres, long. Hair on the head and lanugo distinct; vernix caseosa present. During the month, usually about its middle, the mother, in most cases, first becomes conscious of fœtal movements, and the sounds of the fœtal heart can be heard by auscultation; movements of the fœtus are felt somewhat earlier by the multigravida than by the primigravida. If the fœtus be born at five months, it breathes, cries faintly, and lives longer than when born at four months, but dies in a few hours.

Sixth Month.—The fœtus is 12¼ inches, 31 centimetres, in length, and weighs a little more than one pound, 634 grams. Its form has become rounded by the increase of fat, lanugo covers the body and the members also, except the palms of the hands and the soles of the feet; the growth of hair upon the head is plain, and the eyebrows can be faintly seen, while the secretion from the sebaceous glands furnishes a more abundant vernix caseosa. A fœtus born at the end of six months may live from one to fifteen days. Its death occurs not only because the digestive apparatus is incompletely developed, and because the reduction of temperature is great and rapid, but because the rudimentary condition of the lungs renders respiration almost impossible,[1] for, according to Cornil, at this period of intra-uterine life air cannot distend the final pulmonary ramifications because of their anatomical structure.

Seventh Month.—At the end of the month the fœtus is 13–15 inches, 33–36 centimetres, long, and weighs between 3 and 4 pounds, 1200 grams. The eyelids are open, the testicles begin to descend in the seventh month, and are near the scrotum. The nails are almost com-

[1] Pinard.

pletely formed, the insertion of the cord is about one inch and a half, four centimetres, below the middle of the length of the body. The child is said to be viable at the end of the month, but its viability is only relative to that of earlier birth; the majority of children born at this period die.

A popular, founded upon a professional, belief prevailed for many centuries, to the effect that a child born at seven months was more likely to live than one born at eight months. Possibly this popular belief is not yet quite extinct. It is, however, somewhat astonishing to find the late Dr. John W. Francis, Professor of Obstetrics in the University of New York, in his preface to the American edition of "Denman" (1821), using the following language: "The singular circumstance that a child of seven months' gestation has greater chance of living than one of eight was noticed by him," *i. e.*, Hippocrates. Now, this notion, which was held for more than two thousand years, had its origin in the infancy of obstetric science, and arose from ignorance of the essential cause of labor. It was believed that the fœtus up to seven months had its head in the upper part of the womb, but at that time the increased weight of the head caused this to fall into the lower part of the uterine cavity; the head of a boy, because being of greater size, turning downward somewhat earlier than that of a girl. But as soon as the fœtus had its head at the mouth of the womb, it made an effort to get out, and, if a very strong child, succeeded. If it failed, the effort was repeated at eight months, and in case it then succeeded the fœtus having been weakened by its previous unsuccessful attempt, had less chance of living than if birth had taken place at seven months.

Eight Months.—At the end of the eighth month the length of the fœtus is about 16 inches, a little more than 40 centimetres, and its weight is about 5 pounds, or nearly 2 kilograms. The insertion of the cord is about the middle of the length of the body; only one of the testicles, usually the left, is in the scrotum; during the month the body increases less in length than in breadth.

Nine Months.—The length of the fœtus at term varies from about 19½ inches to a little more than 22, 50–56 centimetres; its weight by many is placed as between six and seven pounds; Landois, however, makes it seven pounds, 8¼ kilos. The last statement corresponds more nearly with that resulting from statistics, including 500 male and 500 female children, taken from the obstetric records of the Philadelphia Hospital.[1] These statistics showed the average weight of female children to be seven pounds one ounce and a half, and that of male children to be seven pounds eight ounces. In only one of a thousand was the weight eleven pounds.

Burns regarded the weight proportion between the sexes in the new-born to be such that twelve males would weigh as much as thirteen females. The late Sir James Simpson has drawn attention to the fact that from the great size of the head of the male the fœtal mortality in childbirth was larger with male than with female children; Bertillon's

[1] I am indebted to Dr. R. J. Phillips, one of my internes two years ago, for preparing these statistics. A curious fact which I have observed in my hospital service is, that there is less difference in weight between the sexes of the new-born in the black than in the white. While a sufficient number of observations have not been made to establish a law, there are *a priori* reasons for believing in the possibility of such a law.

statistics prove that the fœtal mortality in birth is in the proportion of 130 males to 100 females. If a child's weight at birth be decidedly under the average, the probability is that the labor is premature, or else the normal development of the child has been interfered with. So, too, if the weight be much above the average it is possible that in some cases the pregnancy has been protracted beyond the normal time.[1]

In one instance in my practice a child was born weighing only one pound and a half, the pregnancy ending a few days before the completion of the seventh month; the child lived, and is now a healthy boy of seven years.

Dr. R. P. Harris, in a note to "Playfair," states: "We have had children born in this city, Philadelphia, at maturity that weighed but one pound. The well-remembered 'Pincus' baby weighed a pound and an ounce."

In some instances children weighing twelve pounds and even more have been born. But it is remarkable that most of the cases of birth of unusually large children occur in private, not in hospital practice. Pinard, from an examination of the records of the Paris University, found but one in 20,000 that weighed 5300 grams, a little more than twelve pounds.

Harris, op. cit., says, "Probably the largest fœtus on record was that of Mrs. Captain Bates, the Nova Scotia giantess, a woman of 7 feet 9 inches in height, whose husband is also of gigantic build, reaching 7 feet 7 inches in height. This child, born in Ohio, was their second, and was lost in its birth, as no forceps of sufficient size to grasp the head could be procured. The fœtus weighed twenty-eight and three-fourths pounds, and was thirty-nine inches in length. Their first infant weighed nineteen pounds."

Causes affecting the Weight and Length of the Fœtus.—This subject has been especially studied by Hecker, Matthews Duncan, and Wernich. Among their conclusions are the following:—

1. The weight increases with the age of the mother up to twenty-nine years, and the length to forty-four years. (Duncan.)

2. Every product of a repeated pregnancy surpasses in weight and length that of the previous pregnancy. (Hecker.)

3. Age as well as number of pregnancies influences the increase of weight and length, and each factor acts according to a progression. (Wernich.)

4. Very long intervals between successive pregnancies have less influence upon the increase of weight than very short intervals. (Wernich.)

5. The variation of sexes disturbs the increase of weight of the fœtus to the positive detriment of females born later. (Wernich.)

6. The first-born of mothers who menstruated very late are not so large as those of mothers who menstruated early. (Wernich.)

Race, the size of the father, the state of the mother's health during pregnancy, and her condition as to obesity are probably also factors in determining the size of the child.

The Fœtus at Term.—There is no single criterion by which the maturity of the fœtus can be known, but a strong probability, amount-

[1] Kormann, op. cit., believes that pregnancy may last at least two or three weeks beyond two hundred and eighty days, and that then the fœtus may be developed beyond the average so that its weight is 6000 grams, and its length 30 centimetres.

ing to almost absolute certainty, is attained by combining certain characteristics. Thus the fœtus should have the average weight and length that have been given; the body should be plump, and more or less covered with the secretion from the sebaceous glands, this secretion being mixed with the detached lanugo and epithelial scales making the *vernix caseosa*, or cheesy varnish; this covering is chiefly in the groins and axillæ, at the flexures of the joints, and upon the back and chest. The nails of the fingers and toes are hard, those of the former projecting slightly beyond the tips of the fingers; the cartilages of the ear and nose are resisting; the cord is usually a little below the middle of the anterior portion of the body, in girls the insertion is said to be a little higher than in boys; the hair on the head is one to two inches, 2.6 to 5.2 centimetres, long; the child cries vigorously, and makes active efforts at sucking an object placed between its lips.

The Fœtal Head.—This is the part of the fœtus which is usually expelled first, and if it can pass through the birth-canal there is rarely difficulty or delay in the delivery of the body, and hence the knowledge of its form, size, and structure, and the changes in its measurements and shape occurring in labor, is important for the obstetrician. The general shape of the fœtal head is ovoidal, the larger end of the ovoid being posterior. It is composed of cranium and face; the latter is of minor obstetric importance. The bones of the cranium of the fœtus differ from those of the adult's cranium in two important respects: they are to some degree flexible in consequence of incomplete ossification, and they are mobile, because instead of being united together by bone, their union is by fibrous tissue. Further, in the fœtal head mobility of the squamous portion of the occipital results, as pointed out by Budin,[1] from its being united to the basilar portion by cartilage, which serves as a hinge, and the former is moved forward or backward according to the action of external force.

Sutures and Fontanelles.—The membranous spaces between the bones of the head are called sutures and fontanelles. The sutures are straight or curved lines, and the fontanelles are at the junction or at the intersection of sutures; if at the former, the fontanelle is triangular, but if at the latter, quadrangular. The three most important sutures are the sagittal, the fronto-parietal, and the occipito-parietal. The sagittal—from *sagitta* an arrow, meeting the bowstring at a right angle, passes directly over the bend of the bow, and thus intersects the middle of the arc described by the fronto-parietal suture—is the longest and extends from the root of the nose to the upper point or angle of the occipital bone; it is the dividing line between the two halves of the frontal bone, and between the two parietal bones. The fronto-parietal, as its name indicates, is between the frontal and the parietal bones; it ends on either side at the squamous portion of the temporal bone. The occipito-parietal, usually called lambdoidal from its suggested resemblance to the Greek[2] letter lambda, λ, is between the occipital and parietal bones; it may be described as a bifurcation of the sagittal suture.

[1] De la Tête du Fœtus au point de vue de l'Obstetrique.

[2] Its resemblance is greater, as Bailly has said, to a capital V, whose angle corresponds to the end of the sagittal suture.

The chief fontanelles are two, one anterior, the other posterior. The former, also called bregma, from βρέχω to moisten, because of its being so yielding to the touch, is at the intersection of the two sutures, the sagittal and the fronto-parietal, and therefore quadrangular. It is a large,

FIG. 83.

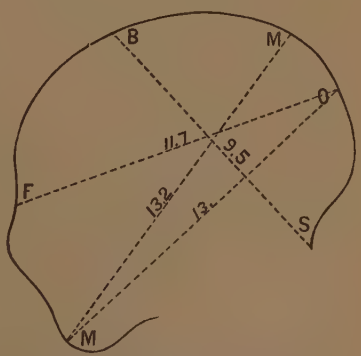
FIG. 84.

ANTERIOR AND POSTERIOR FONTANELLES, SAGITTAL AND OCCIPITO-PARIETAL, AND OCCIPITO-FRONTAL SUTURES.

membranous depressed surface, with unequal sides, the two anterior being longer than the two posterior; these features are so characteristic that its recognition in labor by the touching finger is usually quite easy. The posterior fontanelle is at the junction of the sagittal with the occipito-parietal suture, it is consequently triangular; it is quite small, and in labor cannot, as a rule, be recognized as a membranous space, for in consequence of the movement of the squamous portion of the occipital bone forward, the overriding parietal bones hide it from touch, but its position may be recognized by its corresponding with the point of apparent bifurcation of the sagittal suture, and by its being at the apex of a depressed triangle, two of the converging sides of the triangle being the posterior margin of each parietal bone, and the intervening space occupied by the occipital bone.

Lateral and supplementary fontanelles are also to be noticed. The chief of the former are at the junction of the occipito-parietal and temporal sutures, but they are concealed by soft parts. Supplementary fontanelles are membranous spaces arising from failure of ossification; they are sometimes found in the middle of a bone, sometimes in the course of a suture; remembering these facts as to their position, one is not liable to confound them with

FIG. 85.



ANTERO-POSTERIOR DIAMETERS OF FŒTAL HEAD.

either of the fontanelles that have been described, and which are such important guides in practical obstetrics.

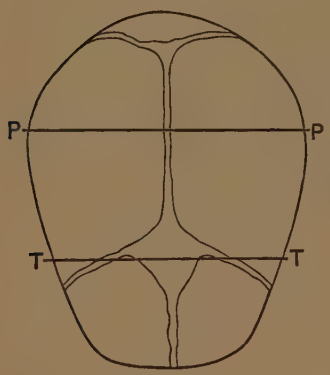
Diameters of the Fœtal Head.—These are lines drawn between certain points of the fœtal head. Following the example of Budin, these diameters may be classified according to their general direction, as antero-posterior, transverse, and vertical. The antero-posterior are four, viz., the maximum, the occipito-mental, the occipito-frontal, and the suboccipito-bregmatic.

The maximum diameter extends from the chin to a variable point, which is in almost every case situated in the sagittal suture between the two fontanelles. The occipito-mental diameter goes from the point or angle of the occiput to the chin. The occipito-frontal is between the angle of the occiput and the root of the nose, and the suboccipito-bregmatic is from the point of meeting of the occipital bone with the nucha to the middle of the anterior fontanelle, that is, where the sagittal and fronto-parietal sutures cross each other.

The transverse diameters are three, viz., the biparietal, between the parietal protuberances, the bitemporal, between the origin of the fronto-parietal suture on each side, and the bimastoid, which extends between the mastoid apophyses.

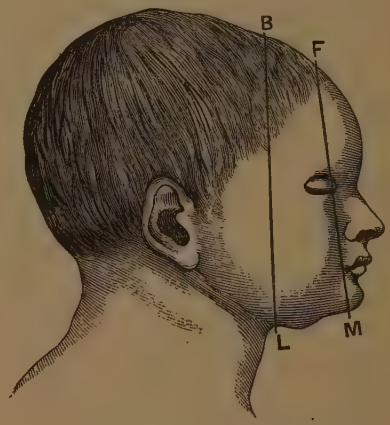
The vertical diameters are two, the fronto-mental, extending between the highest point of the forehead and the chin, and the trachelo-breg-

FIG. 86.



BIPARIETAL AND BITEMPORAL DIAMETERS OF FŒTAL HEAD.

FIG. 87.



VERTICAL DIAMETERS.

matic, from the middle of the anterior fontanelle to the upper and anterior part of the neck in the immediate vicinity of the larynx. This diameter is also called the cervico-bregmatic and the laryngo-bregmatic.

Dr. J. Matthews Duncan[1] has described a suboccipito-frontal diameter as passing from the suboccipital region a little further toward the nucha

[1] Papers on the Female Perineum, London, 1879.

than the suboccipito-bregmatic, and terminating at the highest point of the frontal bone, an inch in front of the centre of the anterior fontanelle; he states that this diameter is one-sixteenth greater than the suboccipito-bregmatic, and a perineum that has borne the strain of the circumference of the fœtal head belonging to the latter, may give way to the greater strain of the circumference belonging to the suboccipito-frontal diameter.

The greatest circumference of the fœtal head is that corresponding with the maximum diameter, and the least that which is similarly related to the suboccipito-bregmatic.

In the following table of diameters and circumferences, the measurements given by Tarnier and Chantreuil are presented. Each metric measurement is followed by its equivalent in inches and hundredths, and this in turn by an approximative measurement, where it seemed most convenient for remembering, substituting vulgar for decimal fractions.

Maximum diameter	13.5 cm.	5.31 inches or	5 1/3
Occipito-mental	13. "	5.11 "	5 1/8
Occipito-frontal	12. "	4.72 "	4 3/4
Suboccipito-bregmatic	9.5 "	3.75 "	3 3/4
Biparietal	9.5 "	3.75 "	3 3/4
Bimastoid	7.5 "	2.75 "	2 3/4
Fronto-mental	8. "	3.15 "	
Bitemporal	8. "	3.15 "	
Trachelo-bregmatic	9.5 "	3.75 "	3 3/4
Great circumference	37. "	14.57 "	14 1/2
Small circumference	32.5 "	12.80 "	12 3/8

Upon comparing these diameters of the fœtal head with those of the maternal pelvis, it will be seen that only two of the former exceed the greatest of the latter; but in normal labor neither of the two is brought in relation with a pelvic diameter.

Modification of Diameters of Fœtal Head in Labor.—Budin has shown that certain modifications in the diameters of the fœtal head are produced by the overriding of bones at the sutures, from the pressure upon the head in passing through the pelvis, and that by these changes the head is changed in shape, the change varying with the position. In general the alterations in the diameters are as follows: The occipito-mental and occipito-frontal diameters are lessened. The maximum diameter is increased. The suboccipito-bregmatic and the bitemporal are lessened. The biparietal is very slightly lessened; but the mastoid not changed.

Movements of the Fœtal Head.—The head may be bent backward or forward so as to come in contact with the body; the first is called complete flexion, and the second complete extension; this movement takes place chiefly in the articulations of the cervical vertebræ, the occipito-atlantoid articulation participating only very slightly. The last articulation, however, permits rotation of the head to the right or to the left through a quarter of a circle. Tarnier, in reply to the question, whether the head can be made to rotate much more extensively without injury to the cord or to the ligaments, states that the fears expressed are purely theoretical, and that a movement of rotation so extensive that the face is turned directly backward may

be made without producing any lesion. This topic will be referred to in another part of the work.

Diameters of the Trunk.—The bis-acromial diameter from one acromion to the other is the longest trunk diameter. It is 4.7 inches, or 12 centimetres; it can be reduced one inch, or to 9.5 centimetres. The dorso-sternal is 3.7 inches, 9.5 centimetres. The bis-trochanteric diameter is 3.5 inches, 9 centimetres. The sacro-pubic diameter is a little more than two inches, 5.5 centimetres; by the flexion of the thighs upon the abdomen and the legs upon the thighs this diameter is nearly doubled, but compression readily lessens it. All the trunk diameters lessen by compression more than do those of the head.

Attitude of the Fœtus in the Womb.—By this is meant the general form and direction of the trunk, and the position of the limbs with reference to it. We have seen that in the very dawn of development the first distinct form which the embryo had was that of a curve, the ends of that curve tending to approach; and the curved form is kept through all intra-uterine life. As shown in the above diagram of the fœtus contained in the uterine cavity, the back is bent forward, the chin inclined to the chest, the arms folded over the breast, the feet flexed, the legs flexed upon the thighs, and the thighs upon the abdomen; the fœtus is thus folded upon itself, making an ovoid, its position being not unlike that of a chrysalis in the cocoon, or a chick in the shell. Harvey's explanation of the attitude of the fœtus was this: "The truth is, that all animals, whilst they are at rest or asleep, fold up their limbs in such a way as to form an oval or globular figure; so in like manner embryos, passing as they do the greater part of their time in sleep, dispose their limbs in the position in which they are found, as being most natural and best adapted for their state of rest." Cazeaux regarded the attitude of the fœtus as representing "a constrained position, which could not have been produced by the mere pressure of the uterine walls upon the child, since the latter is in a cavity much larger than its whole volume; hence it must be referred to the individual itself."

Fig. 88.

Posture of the Fœtus.

As has already been stated, the attitude of the fœtus is the perpetuation of that of the embryo, and the primitive form of the latter must be regarded as one of the factors in causing it. But others are also concerned—indeed, by some made the exclusive factors, Pinard, for example, saying[1] that the causes are material, extrinsic, and belong to

[1] Dictionnaire Encyclopédique des Sciences Médicales.

the pressure forces much more than to the individual—and these will be considered under the next topic.

Presentation of the Fœtus.—By presentation is meant that part of the fœtus which is in relation with the pelvic inlet, and in labor first descends into the pelvic cavity, that part, in a word, which *presents* at the inlet and in the cavity. In about ninety-six per cent. of cases of labor at term the head presents; many obstetric authorities indeed regard this as the only normal presentation, as it is certainly the most favorable. Various explanations have been given of the fact.

The Hippocratic theory held that the fœtus was attached by ligaments passing from the umbilicus to the fundus of the womb, its head being above; rupture of the ligaments occurred at seven months, and then the child immediately turned its head down and attempted to force its way out of the womb. Aristotle held with Hippocrates as to the original position of the child, but added gravity in explaining the turning downward of the head. Trentius, 1564, found in the form of the uterus the reason for the head usually being in its lower portion at labor. The illustrious Paré attributed the presentation to instinct. Dubois sustained this hypothesis, illustrating it by instinctive acts of the new-born seeking the nipple and sucking. Sir James Simpson held that reflex action was not the exclusive but the ancillary cause, using the following language:[1] "At and towards the full term of utero-gestation, the position of the fœtus with its head lowest is thus greatly maintained by the relative *physical* adaptation of the ovoid shape of the rolled-up mass of the fœtus to the ovoid shape of the cavity of the uterus. But this particular adaptation and position of the fœtus would be often lost if no other additional and *vital* means were in operation, as we see, indeed, often happen when the child dies. The other additional means, by whose influence this special position is still further rigorously and carefully sustained, consists of the restoring influence of reflex motions on the part of the fœtus itself."

The gravitation theory proposed originally, as we have seen, by Aristotle, is advocated by some to day as an assisting, by others as the chief cause, notwithstanding the experiments of Dubois, and the criticisms of Simpson, which appear to conclusively disprove it.

One of the most curious of modern hypotheses, mentioned by Cohnstein[2] in his paper upon *Normal Presentations of the Fœtus*, is that of Pröbsting. The head presents because of the efforts of nature to place the orifice of the respiratory organs of the fœtus as near as possible to atmospheric air.

Cohnstein denies that the cause of presentation of the head is in the movements of the fœtus, or in forces external to it, but asserts that it is in the fœtal circulation, for until seven months a larger amount is sent to the upper part of the body, but then the amount of blood is equalized.

For Pinard one law governs the relations between the fœtal and the

[1] Obstetric Works.
[2] Archives Générales de Médecine, 1869 and 1870.

maternal organism, and this law is absolutely the same as the law of accommodation of labor, so well formulated by Professor Pajot: *When a solid body is contained in another, if the container is the seat of alternate movement and rest, if the surfaces are slippery and little angular, the content constantly tends to accommodate its form and dimensions to the form and capacity of the container.*

While this law explains the presentation of the head of the fœtus better than the gravitation theory, or that of instinctive or reflex fœtal movements, it seems probable that it is not the sole cause of the attitude of the fœtus, but merely assists the action of the primitive cause.

Studying Pajot's law, as it relates to presentation alone, we find in the painless contractions of the uterus in pregnancy, in the varying abdominal pressure, and the changes of position of the mother, which have more or less action upon the fœtus, the conditions of movement and rest; the fœtus presents more of a rounded than of an angular surface, and after the secretion of the sebaceous glands begins, this surface is smooth, slippery, and thus, the amniotic liquor assisting, the accommodation of the content to the container is effected. This accommodation fails in those months of pregnancy when the uterus is very much larger than the fœtus. Thus Veit's statistics show that in 247 deliveries between the first of the fifth and the sixth month, the head presented in 140, the pelvis in 95, and the trunk in 12. If the fœtus be dead and macerated, one of the conditions of the law fails, the content is no longer a solid body, and statistics show that in very nearly one-half of the cases where delivery takes place before six months, the pelvis presents.

As pointed out by Sir James Simpson, presentation of the pelvis is common if the child be hydrocephalic; here it is evident that accommodation causes the presentation. In twin pregnancies accommodation is difficult, and Kleinwachter's statistics show presentation of the head in 69 per cent., of the pelvis in 25 per cent., and of the shoulder in 5 per cent. In hydramnios the fœtus is usually small, and thus ample space doubly secured interferes with accommodation, so that malpresentations are common.

Pinard[1] attaches great importance to the action of the abdominal wall in assisting in accommodation, its elasticity and the contraction of its muscles prevent the uterus from departing from the median line, press it at all points, especially upon the sides. He attributes the greater frequency of malpresentations in multiparæ, seven to one in primiparæ, to the relaxation of the abdominal muscles caused by preceding pregnancies. So, also, he attributes to the same cause the frequent changes of position of the fœtus in pregnancy, and the delay in the engagement of the presenting part in the latter weeks. Nevertheless, while admitting the force of these arguments, much must also be attributed, as held by Charpentier, to the greater relaxation of the multiparous than of the primiparous womb, and its larger cavity as explaining, in part at least, these results.

Pinard divides the causes into active and passive. The former are

[1] Op. cit.

the forms of the uterus and of the fœtus in the different periods of pregnancy, the folding together of the fœtal body and limbs, the gliding surface of the fœtus, and the amniotic liquor. The active causes are the contractions of the uterus, the painless contractions of pregnancy, and the contractions and tonicity of the muscles of the abdominal wall.

Physiology of the Fœtus.—The chief fœtal functions are nutrition, circulation, respiration, secretion, innervation, and motility.

Nutrition.—It is supposed that the nutrition of the impregnated ovule is at first by the granular matter, the discus proligerus, which surrounds it when it escapes from the ovisac. In some of the inferior animals the ovule, during its passage through the oviduct, receives a covering of albumen, and probably the same fact exists in the human ovule; if so, this albuminous coat may nourish it. After entering the womb the primitive chorial villi absorb nutritive material from the uterus; the granular contents of the umbilical vesicle probably nourish the embryo, but as the vesicle is atrophied at the end of the fifth week, this supply lasts but a short time.

The question as to the amniotic liquor contributing to the nourishment of the fœtus—that it is the sole or chief supply no one now holds—is still in dispute. According to Fehling, the human embryo has at the sixth week 97.54 per cent. of water; in the fourth month the quantity of water of the fœtus is between 88 and 93; in the fifth, between 88 and 93; in the sixth, between 83 and 90; in the seventh, between 82 and 85; and in the mature fœtus born dead 74.1. Bischoff, however, found in the new-born only 66.4 per cent. of water. Preyer's statements as to the fœtus obtaining water from the amniotic liquor by swallowing, and by absorption through the skin, have been given on p. 124. Further, while the percentage of albumen in the amniotic liquor is very small, the absolute quantity the fœtus obtains may be very great by accumulation; this liquor contains salts, sodium and calcium phosphates, which are important for the development of the fœtus.

Undoubtedly, materials present in the amniotic liquor have been found in the stomach and intestines of the fœtus, and thus it is proved this liquor may be swallowed, but it is not proved that this is the rule, and up to the present most have regarded it as the exception. Moreover, monsters in which the mouth is absent are born well developed, and therefore the entrance of amniotic liquor into the alimentary canal is not essential to nutrition. Further, as pleasantly remarked by Pinard, the same physiologists who assert the nutrition of the fœtus by the amniotic liquor, also hold that the fœtus passes urine into this liquor, and it is singular if such a fluid contributes to its nourishment.

The permanent and certainly the chief, if not the only nutritive supply of the fœtus is secured through the placenta, other means are only temporary or secondary; during the formation of this organ chorial villi, especially those which contribute to its structure, the chorion frondosum, supply nutritive material to the embryo. The growth of the new being is much slower before than after the development of the placenta, the fœtus increasing in weight during the last six weeks of pregnancy

to an amount equal to that which it attained in the first five months. Fœtal nutrition has been compared to that of a vegetable parasite which takes from the circulatory vessels of the plant on which it is developed the materials necessary for its growth.

Reference has previously been made to the fact that solutions of various substances may pass from the maternal to the fœtal blood. The following are the conclusions of Preyer[1] in regard to the reciprocal relation of the maternal and fœtal blood.

First. Easily diffusible substances in solutions may pass from the blood in the sinuses of the maternal part of the placenta into the blood in the capillary villi of the fœtal portion of the placenta.

Second. That as long as there is a sufficient quantity of oxygen present it is actually given off from the hæmoglobin of the maternal blood corpuscles in the placenta to the hæmoglobin of the fœtal blood corpuscles in the capillary villi.

Third. That certain substances in solution, for example, sodium, indigo-sulphate, and potassium iodide, may pass directly from the maternal blood to the amniotic fluid without passing through the fœtal circulation.

Fourth. That easily diffusible substances in solution may pass freely from the blood of the capillary villi into the blood of the sinuses of the maternal portion of the placenta.

Fifth. That oxygen actually passes from the hæmoglobin of the fœtal blood corpuscles in the placenta to the hæmoglobin of the maternal blood corpuscles, if the latter contain only a minimum of oxygen or none at all.

Sixth. Certain substances in solution probably pass in small quantities from the amniotic fluid into the maternal blood.

Seventh. That formed elements probably pass in the normal placenta only when they are extraordinarily small, and then the transmission does not invariably occur, but only under certain conditions; for example, the conditions furnished by the organization as in sheep, or in anomalous conditions, as increased blood pressure, or through the agency of leucocytes that pass over.

Eighth. It is not proven that formed elements pass from the fœtus to the maternal blood in the placenta; such a transmission is, however, possible.

A question of great practical importance was discussed in the New York Obstetrical Society a few years ago, in regard to the possibility of narcotics administered to the woman in labor injuriously affecting the child. Drs. Gillette, Thomas, and Skene, adduced facts which gave strong support to the affirmative. From what has been proved as to the action of atropia in similar conditions, the natural conclusion is that soluble salts of opium will readily pass from the maternal to the fœtal blood. Two milligrams of atropia was given hypodermatically to a woman three hours before delivery; the child was born with dilated pupils which did not react to light. So, too, the belief is probable that a woman who is an opium-eater is liable to give birth

[1] Op. cit.

to a child affected by morphia; it is possible, too, more remote injury may result.

In one case where morphia was administered to a pregnant woman by hypodermatic injection, the fœtal pulse became less frequent and arythmic.

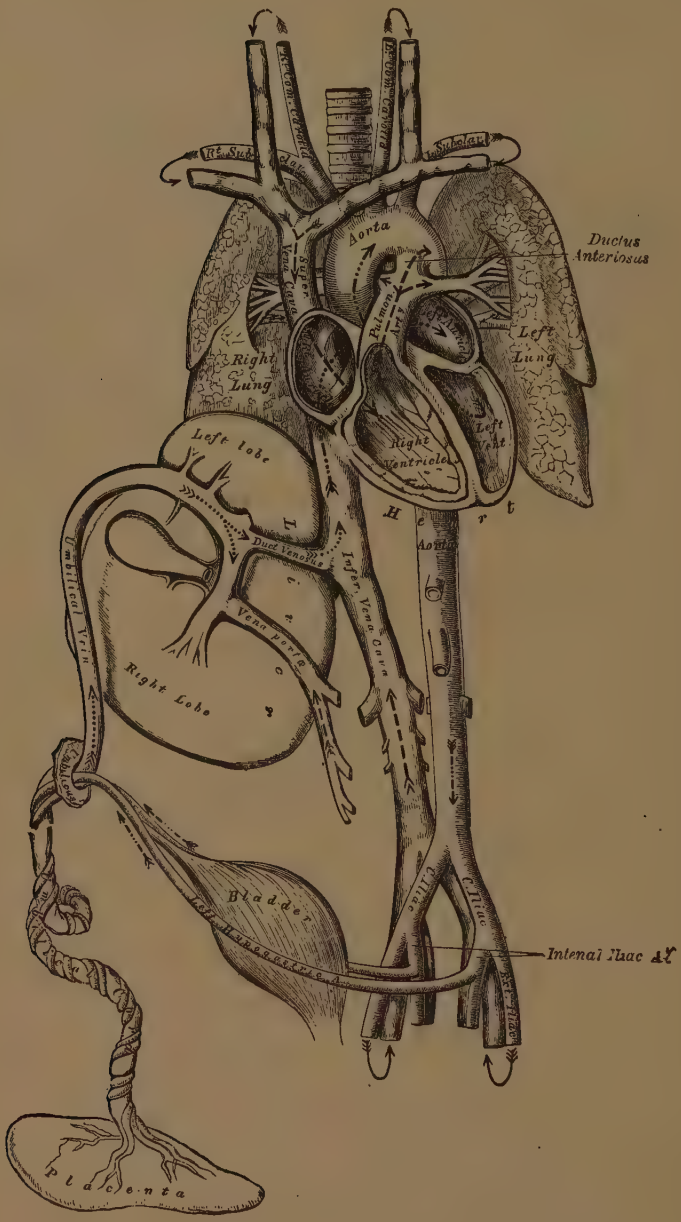
It has been shown by Porak that when fifteen grains, one gram, of quinine was given to a woman in labor, the urine in the child, born an hour and a half afterward, showed the presence of quinine. Runge gave to women during several of the last days of pregnancy half a gram daily of muriate of quinine, and in almost all cases quinine was found in the fœtal urine. Now if, as is alleged by some observers, the child may suffer from intermittent fever while in the uterus, obviously there is every reason to believe that the disease may be cured by giving quinine to the mother.

Occasional cases where intra-uterine vaccination has succeeded, and the transmission of certain diseases believed to depend upon germs, such as syphilis, variola, rubeola, scarlatina, etc., from the mother to the fœtus, testify to the passage of micrococci from the maternal to the fœtal blood.

Circulation.—The circulation in intra-uterine life passes through two important phases, while a third is entered upon at the close of that life. The first is very brief, and depends upon the formation of the umbilical vesicle; it is called the vitelline circulation. The heart, still a straight, tubular cavity, gives off from each end two vessels; the two superior are the first aortic arches, and the inferior are the omphalo-mesenteric veins. By the heart's systole the blood entering the aortic arches passes first into the body of the embryo, then into the omphalo-mesenteric or vitelline arteries, which carry it to the vascular area of the vesicle; from there it enters the venous sinus, situated at the periphery of that area. The omphalo-mesenteric veins are formed by branches originating at the sinus, and empty the blood thus collected into the heart during its diastole.

Second, or Placental Circulation.—The vitelline is superseded at the beginning of the third month by the placental circulation. The heart is developed into an organ of four cavities, and externally presents the form of the adult heart; internally there are important differences. The most important of these differences is that the septum between the auricles is imperfect; it has a large opening, described by Galen, but to which the name of Botal has been given; it is also called the foramen ovale. Furthermore, the Eustachian valve situated at the entrance of the inferior vena cava is remarkably developed, so that it turns the current of blood coming through the latter vessel into the auricle to the foramen ovale, and thus into the left auricle. Two important structures must also be mentioned before describing the circulation, the venous duct and the arterial duct, ductus venosus, and ductus arteriosus; the former connects the umbilical vein with the inferior vena cava; the latter, the ductus arteriosus, which appears as if a continuation of the pulmonary artery, connects the artery with the aorta at a point of the arch just below the origin of the arteries of the head and upper limbs.

FIG. 89.



PLAN OF THE FŒTAL CIRCULATION.

The blood, purified and rendered fit for nutrition in the placenta, is brought to the fœtus by the umbilical vein, which enters at the umbilicus; the greater part of the blood passes at once by the ductus

venosus into the ascending vena cava, where it mixes with the blood brought from the lower limbs, the pelvis and the kidneys; a small part passes to the liver, and on the other hand blood from the hepatic veins empties into the cava. These various collections, chiefly of course that which come from the placenta, make the common stream which is carried by the vena cava into the right auricle, but the stream is turned by the Eustachian valve through the right into the left auricle, from which it passes, as in post-uterine life, into the left ventricle. The heart now contracting, the blood it contains is sent from the left ventricle into the aorta, from the right into the pulmonary artery. The blood which passes into the aorta from the left ventricle passes chiefly to the head and upper limbs; that which enters the pulmonary artery being needed in only small amount by the inactive lungs, and these organs incapable of exercising their function the blood does not need them, therefore the greater part of it is carried by the ductus arteriosus into the aorta; as the ductus venosus transmitted a purified blood, so the ductus arteriosus conveys an impure blood. The aorta, after the ductus arteriosus has emptied its supply into it, contains blood from both the left and the right heart, and transmits this mixed blood to the organs situated below, to the lower limbs, and by the umbilical arteries to the placenta. The blood which was expelled from the right ventricle had been received from the descending vena cava through the right auricle, and it was therefore an impurer blood than that which was expelled simultaneously from the left ventricle; thus it is plain that the lower half of the body has a blood less rich in nutritive materials than the upper half, and hence the greater development of the latter than of the former, a development which is necessary for the exercise of certain functions in the period of life immediately following delivery. The organ which receives the purest blood is the liver.

At birth that which is often called the third circulation is established. With the first inspiration of the new-born, the blood flows in increased quantity to the lungs, and the stream which passed from the pulmonary artery to the aorta through the ductus arteriosus, now goes into the branches of the pulmonary artery, and the arterial duct is narrowed, and obliterated in two or three days. The blood coming from the lungs fills the left auricle, prevents that which enters the right auricle passing through the foramen ovale; this opening in the wall between the auricles, not being used, is closed, the closure not being completed until some weeks after birth.

Respiration.—The placenta is the respiratory organ of the fœtus. As remarked by Spiegelberg, the mother's blood is for the fœtus the external world from which alike its respiration and nutrition needs are satisfied. The importance of a supply of oxygen for the fœtus is rendered probable by the abundance of hæmoglobin in its blood. According to the investigations of several, the blood of the mature fœtus is richer in hæmoglobin than is that of the mother. Hoesslin found, too, in fœtal blood which contained 13.72 per cent. of hæmoglobin, there were 5.88 millions of blood corpuscles in a cubic millimetre of the blood, a very much larger number than woman's blood has. Preyer,

from his own investigations, has concluded that the hæmoglobin in the pregnant woman's blood is never greater, often very much less, than in that of the fœtus.

He also states that important changes of matter occur in the fœtus, as shown by the formation of certain products which are not obtained from the mother's blood, secretions from its glands, or building up permanent structures; exercise of voluntary and of involuntary muscles; the fœtus, too, has a higher temperature than that of the mother's uterus; and all these things indicate the fact that oxygen is necessary for the fœtus. The only source of supply is the maternal blood. The proofs of fœtal blood changes in the placenta, analogous to those which occur in pulmonary respiration, are the difference of color in the blood coming from and going to the placenta; the fact that, if the placental circulation be temporarily interrupted, the blood in the umbilical vein becomes dark like that in the arteries, and, if the interruption be permanent, the fœtus dies asphyxiated, and the only substitute for placental is pulmonary respiration; finally, spectroscopic examination has proved the presence of oxygen in the fœtal blood.

It has been held that the fœtus requires but a small quantity of oxygen because of the nutritive changes being so simple, and its activity so slight. But it should be remembered[1] as to the latter point that the heart begins its action early, and that its pulsations are twice as frequent as in the adult; that fœtal movements occur some time before the mother is conscious of them, and that very many take place after she has this consciousness without her recognition, for only those affecting that part of the uterus which is in relation with the anterior abdominal wall can be known by her. In answer to the statement that the nutritive changes are slight, Weiner,[2] from his study of these changes in the fœtus, has concluded that there exists in the fœtus, especially in the last period of fœtal life, a certain number of organs which function as in the new-born. The kidneys act, and this quite early, in relation to certain known substances artificially introduced into the fœtus, exactly as the kidneys of the new-born, and very rapidly excrete these products. Absorption by the lymphatics and the rapidity of the lymph currents are very energetic; the intestinal mucous membrane not only absorbs substances in solution, but also fat. These facts connected with that of the active secretion of the liver, of the skin, and of the glands of the intestinal mucous membrane, as well as the relatively pronounced development of digestion in the stomach, and the fermentation properties already present in the extracts of the parotid and of the pancreas, permit us to admit with great probability that the secretory and absorbent organs of the fœtus are capable of performing their functions, and very probably do perform them, as soon as their anatomical structure and degree of development permit.

It is commonly held that during placental, as in pulmonary respiration, carbonic acid is eliminated from the blood which receives oxygen. But Preyer observes that although the consumption of oxygen by the fœtus, as well as the intra-uterine breathing of oxygen without a specific respiration organ be established, nothing is proved as to the intra-uterine discharge of carbonic acid. The presence in the fœtus of oxidation products not derived from the mother, as allantoin, make it

[1] Preyer, op. cit.

[2] Archiv für Gynäkologie, 1884.

very probable that carbonic acid is produced, though in small quantity, and given off by the fœtus.

Secretion.—The formation of the sebaceous glands begins towards the end of the fourth month, and in the fifth month their secretion is manifested, and in the sixth month becomes quite abundant. The *vernix caseosa, smegma embryonum*, which covers so generally the surface of the embryo, is a whitish or yellowish, inodorous, adhesive matter composed of epidermic cells, sebaceous cells, and fat-globules. The epidermic scales make the greater part of the mass, the amount of fatty matter being relatively very small. Depaul, who did not disdain a belief in nature's intelligence, regarded the vernix caseosa as a wise provision to prevent osmosis from the fœtal vessels.

The sudoriparous are developed somewhat later than the sebaceous glands, and probably do not secrete during intra-uterine life, though one of the many theories of the origin of the liquor amnii was that it was formed by their secretion.

That the serous membranes of the fœtus have their normal secretion, is shown by those cases in which children are born having this secretion in excess, as in cases of hydrocephalus, of hydrothorax, and of ascites.

The remarkable vascularization of the liver in the fœtus is, according to Kölliker, proof of its great physiological importance: but he regards its *rôle* as an organ of secreting bile as subordinate to that of producing in the blood special chemical and morphological modifications. The secretion of bile begins in the third month; a bile-like material is found in the fifth month in the small intestine, later in the large intestine, the precursor of meconium. The first excrement of the new-born has been called since Aristotle μηχωνιον, meconium, from its resemblance to the juice of the poppy. Its presence indicates not only secretion from the liver, but also the activity of the intestinal glands, and its descent into the lower portion of the large intestine peristaltic action of the intestinal canal. From the seventh to the ninth month of fœtal life it presents almost the same characters as after birth; it is homogeneous, viscid, feebly acid, without odor, with a greenish, sometimes almost black color; it is composed of bile and intestinal secretions with, in exceptional cases according to some, in all cases according to others, materials derived from the amniotic liquor, such as sebaceous secretion, epidermic scales, and fine hairs.

Preyer states that Huber has described two kinds of meconium which are frequently found in the fœtal intestine, namely, the amniotic meconium, which has as its component the swallowed amniotic liquor, and which is yellow-brown, and the hepatic meconium, which contains bile, and is dark green. The latter is also characterized by the presence of yellow-green chiefly ovoidal bodies from 0.005 to 0.03 millimetres in diameter, which Huber has called meconium corpuscles. The forensic proof of meconium may be given by these corpuscles, they are generally surrounded by mucus, insoluble in ether and in acetic acid, but soluble in potash solution.

Discharge of the meconium prior to birth rarely occurs except as a pathological manifestation; it is often observed in children born asphyxiated. The kidneys are exercised during the last half of preg-

nancy; upon an autopsy made of a fœtus dying during pregnancy, it is usual to find urine in the bladder, and it is not uncommon to see urine escape from the new-born just after delivery, while in some cases it is expelled during labor; hydronephrosis may occur in pregnancy from obstruction of the ureters. Although still in dispute, the probability seems to be that the fœtus from time to time empties the bladder into the amniotic liquor, for, in addition to the presence of urea in this liquid, in cases of imperforate urethra the bladder is found enormously distended.

Fœtal Movements—Innervation.—Fœtal movements are usually perceived by the mother some time in the fifth month. According to Preyer, the fœtus moves its upper and lower limbs long before the beginning of the sixteenth week, probably long before the twelfth week. Many of the movements of the fœtus are passive, caused by change in the mother's position, by varying abdominal pressure, by uterine contractions, and by external pressure upon the uterus. Others result from changed conditions of the maternal blood, and they are termed irritative movements; many are reflex, and others impulsive. The life of the fœtus is compared to that of a dreamless sleep after birth. But, as Bailly has said, it is probable that a vague and obscure will intervenes in the production of movements which the fœtus exercises after a change of position of the mother, and which appears to have as their object the recovery of a comfortable position of which the movement of the mother has deprived the fœtus. Nevertheless, this view is not supported by Preyer.

The question as to the sensibility of the fœtus to sense impressions is not one readily answered. As far as sight, hearing, and smell are concerned, no such impressions are possible. Preyer regards it as probable that the development of the sense of taste is the earliest. Kussmaul has shown in one child born at eight, in another at seven months, that impressions upon the gustatory nerves were very distinct, as shown by the different expressions of face and movements of its muscles, as well as those of the mouth, according as sugar or quinine was placed upon the tongue. Jacquemier, Tyler Smith, and Tarnier have each tried the following experiment: The uterus of a pregnant rabbit being exposed, the foot of one of the young was seized with forceps through the thin, transparent uterine wall, and immediately the animal withdrew the member. But this movement on the part of the fœtal rabbit has been by many regarded as simply reflex, and not indicative of pain, though probably such interpretation is erroneous. The imperfect development of nerve ends is regarded as preventing the sensation of pain from external impressions upon the fœtus. Nevertheless, as stated by Tarnier, during intra-uterine life, especially at the end of pregnancy, innervation ought probably to be almost as complete as in the new-born. It is probable too, as suggested by Harvey, there are periods of alternate rest and action in the life of the fœtus. Doubtless the intra-uterine exercise of the voluntary muscles contributes to their development, if not to the general development of the fœtus.

CHAPTER III.

CHANGES IN THE MATERNAL ORGANISM—MULTIPLE PREGNANCY.

THE changes in the impregnated ovule having been traced from their beginning in conception to their end in the completely developed fœtus, there are now to be considered the modifications which pregnancy causes in the maternal organism, in a word, to present the natural history of pregnancy in regard to the mother. The changes in the maternal organism caused by pregnancy, may be divided into general and local.

General Changes.—These chiefly involve the digestive apparatus and nutrition, the heart and the blood, respiration, the nervous system, the skin, and the urinary apparatus and secretion.

Morning Sickness.—Gastric disturbance is an almost constant phenomenon manifested in the first months of pregnancy. From the fact that nausea and vomiting are more frequent in the early part of the day, or if occurring at other times are usually more severe then, the disorder is commonly known as morning sickness. In some cases it may be so slight as to scarcely constitute an indisposition, only a transient discomfort, but in others so severe as to be a grave disease. It may begin soon after the supposed time of conception, but more frequently at the first following menstrual suppression; in either case it usually abates or disappears some time in the fourth month. In most cases the desire for food is lessened, and in those where the nausea is great or constant, disgust may take the place of desire.

In a very few cases pregnancy seems from the first to increase the appetite, digestion is good, and the subject is in better health than usual. In still others the appetite may be capricious, fickle as to kinds of food, or wishing for those articles which at other times are not cared for, or, finally, it may be perverted. The whimsical or perverted appetences of pregnant women, commonly known as "longings," are in some cases assumed, or imaginary, not real; a primigravida, for example, has read or heard stories of such "longings," and believing them natural to her condition, the step is but a short one to imagining she has them. In the word mother-marks there is perpetuated the once popular belief that if the desire or longing of the pregnant woman for some particular article of food is not gratified, the fœtus will be marked.

Pliny used the word *malacia* to express the "longings" of pregnant women. A distinction has been made by some between *malacia* and *pica*, the former being used to signify that the appetite sought unaccustomed, but still nutritious, substances for food, while in the other there was a complete perversion of the appetite which sought materials such as chalk or

charcoal, that were entirely indigestible, or which were repulsive and disgusting, like feces. But this distinction has not been generally held.

The word *pica* is the Latin for magpie, and was used, Gardien says (*Traité complet D'Accouchmens*), to signify the whimsicalness of pregnant women and of chlorotic girls, because there was thought to be an analogy between their appetites, and the parti-colored plumage of the magpie, or its inconstancy as shown in hopping from one to another branch of the tree on which it is perched.

Strange stories have been told of these "longings," as, for example, of a pregnant woman who longed for salted herring, and ate fourteen hundred during her pregnancy, or of another who longed for a bite of the baker's shoulder, and the kind husband, fearing he would lose his wife if the longing were not gratified, got the baker's consent, and she took two bites; and of another who longed so earnestly to eat her husband that she killed him, ate heartily of his body, and then pickled the rest for future consumption.

These longings have been well satirized by Ben Jonson, in the following passage from Vanity Fair: "O, yes, Win, you may long to see as well as to taste, Win, as did the 'pothecary's wife, Win, who longed to see the anatomy, Win. Or the lady, Win, that desired to spit in the great lawyer's mouth after an eloquent pleading."

In the latter part of pregnancy before descent of the uterus has occurred, and while the fundus is pressing upon the stomach, some women have a recurrence of gastric disorder, but this is slight and transient. Neither this manifestation nor that of the earlier months should be confounded with the graver form of the disorder, which may occur as a symptom of albuminuria and a forerunner of eclampsia.

It is easy to understand, as observed by Stoltz, that the irregularity or depravation of the digestive functions in the early months of pregnancy must cause imperfect nutrition. "Hence the pregnant woman emaciates in the first month; her appearance is bad, that is to say, her features are drawn, her eyes surrounded by dark circles, and her expression becomes more or less dull. She is sluggish, melancholy, drowsy. In a word, there is developed a condition more or less resembling chloro-anæmia." But the nausea generally ceasing with the beginning of the fourth month, and before or by the middle of this month, fœtal movements being recognized by the mother, all uncertainty as to her condition is removed, the appetite is restored, digestion becomes better, her general condition is greatly improved, nutritive processes are quickened, and she gains in weight. This increase of weight is greatest in the last three months of pregnancy, being, according to the investigations of Hecker and Gassner, from one kilogram and a half to two kilograms and a half each month. A woman's weight is about one-thirteenth greater at the end than it was at the beginning of pregnancy. "In the cases when the weight lessened in the eighth or ninth month, Gassner ascertained conditions unfavorable to nutrition, for example, the death of the fœtus, and its retention in the uterus. This phenomenon, observed in three instances, always had as its consequence a diminution of the weight of two to three kilograms in a period of eight to fifteen days."[1]

[1] Tarnier.

Changes in the Blood and Circulatory Apparatus. — The blood changes resulting from the pregnant state relate to quantity and quality. There is a decided increase in the amount of blood, this increase beginning about the middle of pregnancy. When we consider the increased nutritive demands, especially for the fœtus and its appendages, and for the uterus, and the larger area of the circulation, an increase in the quantity of the blood is obviously necessary. The qualitative changes of the blood concern its constituents, water, albumen, corpuscles, fibrin, and iron. The water increases from 791.1 to 1000, the normal amount in the non-pregnant, to 801.6, or, according to Regnault, to 819.9 in the last month of pregnancy. The red globules, normally 125 or 127, lessen to 104.49. At the same time the white globules increase in number, but not to a degree compensating for the loss in the red. The albumen lessens from 70.5 to 66.1. The fibrin, normally 3 to 1000, lessens until the sixth month, then increases so that at the end of the last month it is 4.3. This remarkable increase in fibrin above the normal amount found in the non-pregnant state, rendering the blood more coagulable, Tarnier suggests may be of advantage in preventing hemorrhage after the delivery of the placenta. The iron in the blood is diminished; this obviously follows from the lessened number of red corpuscles.

Hypertrophy of the heart, as a constant phenomenon of pregnancy, was first made known by Larcher in 1857. This hypertrophy, like that of the uterus, disappears after the pregnancy has ended. By Blot the increase in the weight of the heart was stated to be about one-fifth. Letulle[1] claims that physiological hypertrophy of the heart is not a constant fact, but that dilatation of the cavities always occurs. According to observers the hypertrophy is almost exclusively of the left ventricle.

The greater activity of the circulation is manifested by increased arterial tension. The veins, too, are fuller, and varicose enlargements frequently occur.

Respiration.—The base of the thorax is increased during pregnancy, while its vertical and antero-posterior measurements are lessened; but the former increase in the pulmonary capacity cannot compensate for the loss resulting from the two other changes mentioned. Hence the pregnant woman, when the uterus has risen so high as to interfere with the normal descent of the diaphragm in inspiration, suffers from hurried breathing, or from dyspnœa when making great bodily exertion, as in hurried walking or ascending steps.

The quantity of carbonic acid eliminated by the lungs constantly increases as pregnancy advances.

Urine and Urinary Apparatus.—The blood now being increased, as well as the arterial tension, the quantity of urine secreted is greater. But this increase of urine is almost exclusively of its watery portion; with the exception of the chlorides, the solid constituents progressively lessen with the duration of the pregnancy. The lessened elements are phosphates, sulphates, urates, uric acid, creatin and creatinin; and

[1] Archives Générales de Médecine, 1881.

the suggestion, which in part seems quite probable, has been made that the lessened elimination of these in the urine may result from their being used in fœtal development.

Kyestine, from the Greek κυησις, pregnancy, is, as described by Nauche in 1831, a white, grumous, soft pellicle found upon the urine of a pregnant woman about thirty-six hours after it has been passed; about the fifth day this pellicle breaks up, and falls to the bottom of the vessel. The late Dr. Elisha Kent Kane, who became so famous as an Arctic explorer, in 1841 verified by observations at the Philadelphia Hospital the statements of Nauche and other foreign investigators as to the presence of kyestine in the urine of pregnant women, and as to its character. Subsequent investigations, however, have proved that kyestine is not an organic substance, but is chiefly composed of ammonio-magnesian phosphates, vibrions and monads; it may be found in the urine of the non-pregnant as well as in the urine of pregnant women, and also in that of the male.

Renal congestion may result from compression, and albuminuria follow. According to Spiegelberg, it is not rare to find albumen in the urine, especially during the latter weeks of pregnancy, and he regarded it as usually depending upon a vesical catarrh. The results of observations made at the Philadelphia Hospital lead me to believe that albumen is not found in the last month of pregnancy oftener than in one out of ten women. In a very small proportion, probably not more than 6 per cent., sugar is present in the urine in the last weeks of pregnancy.

The close attachment of the bladder to the uterus produces changes of position of the former, corresponding with those of the latter organ; thus, in the earlier weeks of pregnancy, the bladder descends somewhat with the uterus, and its full expansion is prevented; hence vesical irritability is one of the first symptoms of pregnancy. Observation shows that the majority of pregnant women suffer from some disturbance or disorder of the bladder, primigravidæ being more liable than multigravidæ to these disorders.

Changes in the Skin.—Pigment deposits may occur upon the face, the forehead, the mammæ, the labia, and upon the abdominal walls. Pigmentation of the mammæ and nymphæ will be described in another place. Irregular yellowish brown patches upon the forehead and the face, form what has been called the mask of pregnancy. The intensity[1] of the color varies in different subjects; the patches become less distinct after pregnancy, but do not disappear, and are renewed at each succeeding pregnancy. In most cases a pigment deposit is found in the median line of the abdominal wall; it is more marked in brunettes than in blondes, but is very indistinct in those having red hair. The pigment band is two or three fingers' breadth, and reaches from the

[1] "Bomare, in an article cited by Blumenbach, mentions a French peasant, whose abdomen became entirely black during each pregnancy; and Camper gives an account of a female of rank who began to be brown as soon as she was pregnant, and before the end was as black as a negress. After delivery the color gradually disappeared. Le Cat relates the case of a female who was similarly affected in the face only during three successive pregnancies; and Gardien has recorded another." (Laycock on The Nervous Diseases of Women.)

mons veneris to the umbilicus, in some cases to the xyphoid cartilage, and then there is a ring of discoloration about the umbilicus, the umbilical areola; the band is more distinct below than above. No satisfactory explanation of these discolorations has been given. Dr. Barnes[1] has suggested that the pigmentation of pregnancy is dependent upon a functional modification of the supra-renal capsules, while Jeannin[2] suggests the amenorrhœa of pregnancy as the cause. Localized[3] eczema and seborrhœa, especially upon the face and head, are often seen.

The anterior wall of the abdomen becomes thinner. The enlarged uterus causes it to project, the projection being much more marked when the woman is standing than when she is lying; thus, according to Schrœder, the measurement at the end of the pregnancy, from the xyphoid cartilage to the pubic joint is, if she be standing, eighteen inches and a half, 47 centimetres, but if she be lying, it is a little less than sixteen inches, 40 centimetres.

During the first three months of pregnancy the umbilical depression is slightly increased, or unchanged; in the fifth month it has become less, and at seven months has disappeared; in the last two months there is more or less umbilical protrusion.

Striæ, *striæ gravidarum*, *lineæ albicantes*, or cicatrices of pregnancy, usually occur in the first pregnancy, and it is not uncommon for new ones to be observed in subsequent pregnancies. These striæ are in most cases abdominal, but in some are found upon the hips and thighs, and then are not connected with the pregnant state, or they are upon the breasts; the last in most instances originate after labor. When recent they have a pinkish or bluish red tint, but after labor they become white, or pearl colored; generally their surface is depressed, but in some cases, as the result of serous effusion from compression of the epigastric vein, it is prominent. They are caused[4] by partial or complete atrophy of the lymph spaces, partial atrophy of the skin, and longitudinal arrangement of the fibres of connective tissue. They are generally in four concentric zones, the centre being an inch or more below the umbilicus. They do not usually become well marked until the seventh month, and in the primiparous are a sign of some value in the diagnosis of pregnancy; nevertheless they are absent in from six to ten per cent. of pregnant women. Montgomery[5] mentions the case of a woman who had borne five children, nursing three of them, and yet there were no cicatrices. According to Credé they are absent in 10 per cent., and according to Hecker in 6 per cent. Schultze has found them in 36 per cent. of women who have not borne children.

Changes in the Nervous System.—Pregnancy increases nervous sensibility, and hence numerous reflex disturbances may occur. There may be occasional rigors, dizziness, flashes of heat, hysterical disorders,

[1] Transactions of the American Gynæcological Society, vol. i.
[2] Gazette Hebdom., 1868. [3] Spiegelberg.
[4] See contribution by Dr. Busey. Transactions American Gynæcological Society, vol. iv.
[5] Signs of Pregnancy.

fainting, disturbances of special senses, especially of sight and hearing, and neuralgic affections, those of the teeth being very frequent.

In regard to the mental state, the general rule is women become more sensitive, and in the majority, propably, despondent feelings prevail. Dr. Hodge has remarked that "gestation has a very happy influence upon the minds of a few women; they feel well, their mental powers are active, their imagination excited so they become more interested in reading, writing, or other intellectual pursuits than at any former period; they become more cheerful, and more interested in the ordinary affairs of life." Unfortunately this picture is of the few. A larger number have needless anxiety as to their safely passing through with their labor, and as to the life and health of their offspring. The majority, however, as the pregnancy goes on, become reconciled to their condition, and patiently wait its end, while some indeed look forward to becoming mothers with joyful expectation. Even in those women whose pregnancy is marked by despondency and anxiety, it is not unusual as it approaches its end to find the cloud lifting, and they are ready to meet their final trial patiently, bravely, and hopefully.

Osteophytes—Hypertrophies of Various Organs.—Before describing the modifications of the sexual organs caused by pregnancy, brief reference will be made to some other changes. Osteophyte was the name given by Lobstein to a bony formation originating from the bone, or from the periosteum. Rokitanski, in 1838, found in post-mortem examinations that in more than one-half of pregnant women there were growths upon the internal table of the cranial bones, and external to the dura mater bone-like formations which he called osseous neoplasms or osteophytes. Similar deposits have been found upon the inner surfaces of the pelvic bones of women dying in childbed. Osteophytes have no effect upon the cerebral functions, nor do they belong exclusively to pregnancy, for they have been found in the tuberculous. In addition to hypertrophy of the heart, which has been referred to, and that of the uterus, which will be hereafter described, some other organs, among which are the spleen and thyroid gland, increase in size in the pregnant woman. The increase in the spleen is about one ounce and a quarter, 40 grams. Since Democritus, swelling of the neck has been popularly regarded as one of the signs of conception, and Cazeaux has remarked that hypertrophy of the thyroid gland, independent of any local disease or of endemic influence, is not rare during pregnancy. If the thyroid be hypertrophied in a pregnancy, the hypertrophy lessens subsequently, but does not entirely disappear, and it increases with each succeeding pregnancy. It is probable that the kidneys become somewhat larger in the pregnant woman.

Local Changes.—Under this head it is proposed to describe modifications which occur in the external and internal genital organs, and in the parts adjacent to them, in the pelvic joints, and in the mammary glands.

Changes in the External Organs of Generation and of the Vagina.—It is not until about the fourth month of pregnancy that changes in the external genitals are noticeable. The secretion of the vulvar glands is increased; the large and the small lips are larger, more

elastic, resisting, and darker, pigmentation often being quite decided upon the external labia; the veins and venous plexuses are fuller; in some cases varicosities are present; the vulvar orifice is more open. A greater supply of blood to the vagina causes distinct throbbing of the vaginal arteries—the vaginal pulse—which Osiander spoke of as one of the signs of pregnancy. From venous stasis the color of the vagina changes, becoming much darker, so that it is purple or of a violet hue, which is regarded by Jacquemin and Kluge as an almost certain sign of pregnancy; but its value is lessened by the fact that a similar change of color has been observed in menstruation. The temperature of the vagina is slightly increased; its mucous membrane is swelled; a more abundant secretion is present, and the papillæ are larger, and more distinct, so that the surface becomes rough. The muscular coat, especially in the upper half of the vagina, is hypertrophied. The vagina is lengthened by the ascent of the uterus, but shortened again when the uterus descends, and also then greatly expanded, admitting the entrance of the presenting part of the fœtus covered by the uterine walls.

Changes in the Perineum.—The perineum is more freely supplied with blood, it is somewhat hypertrophied, and it is gradually prepared for the great distension to which it is subjected in labor. Tarnier states that in many experimental applications of the forceps in women who died in pregnancy, or soon after labor, and in others who died not having been pregnant, he found in the last the perineal floor quite resisting and very liable to rupture.

Changes in the Pelvic Joints.—These joints are swelled and softened, and some movement in the pubic joint can usually be detected, but the opinion that in either this, or in the sacro-iliac joints, there is sufficient movement to facilitate labor by increase of pelvic diameters is not generally held by obstetricians. An important movement, however, does occur in the sacro-coccygeal, or in an inter-coccygeal joint, by which the antero-posterior diameter of the outlet is increased.

Changes in the Uterus.—These are the most important of all the modifications in the maternal organism caused by pregnancy. They affect the structure, size, capacity, form, weight, position, relations, and functions of the uterus. Some of the modifications of the uterus may occur independently of the presence of the ovum in its cavity, for they are present in extra-uterine pregnancy, but they are then limited in degree and in duration. It will be convenient to consider first the changes which occur in the body, and then those in the neck of the uterus.

FIG. 90.

MUSCULAR FIBRES OF NON-PREGNANT UTERUS.

Modifications of the Uterine Walls.—A larger supply of blood to the uterus causes increased growth of its tissues. The muscular fibres become relatively collossal, increasing from seven to eleven times in length, and from two to five times in breadth; "embryonic muscle cells, that have been stored up for the time of need," now grow into larger and

contractile forms; both hypertrophy and hyperplasia occur. The serous coat is also developed in correspondence with the general growth

FIG. 91.

MUSCULAR FIBRES OF PREGNANT UTERUS.

of the organ, but its connection with the underlying muscular tissue is probably as intimate as in the non-pregnant condition.

The very great hypertrophy of the mucous membrane has been stated, and the early history of the deciduous membranes traced. By the end of the third month of pregnancy the decidua of the ovum, ovular decidua, *decidua reflexa*, and the uterine decidua, *decidua vera*, are in contact. It has been taught by Breschet and Velpeau that in the space at first intervening between these two membranes, a fluid called hydro-perione was collected; but this view is not now accepted. In the course of the fourth month the two membranes become closely united, making a single membrane, which in turn is closely united with the chorion, the external covering developed by the ovum, and thus the ovum has not only the closely united chorion and amnion, but also external to these the doubled decidua of maternal origin. The mucous membrane of the uterus in pregnancy ceases to be covered with ciliated, but has pavement epithelium.

The decidua, formed by the conjoined ovular and uterine decidua, atrophies, grows thinner, and in preparation for being thrown off with the ovum gradually becomes detached from the uterus. But the muscular tissue is not left bare by this detachment. Some physiologists, among them Robin, asserted that a new mucous membrane begins forming behind the decidua at four months; Dr. Matthews Duncan's criticism upon this view is that it implies that at some time the muscular tissue was left bare, and that it produces upon its surface a mucous tissue heterologous to it. According to Friedlander, the decidua is at the end of pregnancy reduced to two layers, superficial and deep; the latter is composed of glandular cul-de-sacs and connective tissue, and the former of cells in fatty degeneration, and this only is thrown off. Engelmann also states that only the superficial part of the decidua vera is discharged. Ercolani[1] taught that the uterine decidua was a product of materials elaborated by the utricular glands, and that the ovum, arriving in the uterus already covered by this decidua, soon itself receives a similar investment, this covering fixing it at a particular part of the uterus. The deciduous membranes were regarded by

[1] Utricular Glands of the Uterus. Translated from the Italian by Dr. H. D. Marcy.

him as exudations, new formations. His views have not met professional acceptance.

Modifications of Arteries and Veins of the Uterus.—The arteries of the uterus increase in length, in volume, and in number. Jacquemier has stated that their increase in length cannot be attributed to their becoming less flexuous, for they are more flexuous at the end of pregnancy than they are in the absence of pregnancy. The ovarian arteries acquire a diameter of nearly one-sixth of an inch, four and a half millimetres, and the uterine arteries are still larger; the branch on each side connecting the uterine and the ovarian arteries is larger than the radial; its course is nearly parallel with the epigastric, and it has received from Glenard,[1] who thought it the seat of the uterine souffle, the name of puerperal artery. Arteries upon entering the uterus suddenly enlarge; branches of the one side anastomose freely with each other and with those from the other side; they are situated nearer to the peritoneal than to the mucous coat, except in the vicinity of the placenta; those which pass to the mucous coat make numerous subdivisions, and end in an extensive capillary network. The venous system in the muscular coat is composed of a large number of sinuses or large canals which communicate with each other; some of the vessels are as large as the little finger. They are without valves, and in the middle muscular layer are reduced to a single coat, which, however, is closely adherent to the surrounding muscular fibres. They are more numerous in the vicinity of the placenta. The ovarian veins become almost equal in size to the external or internal iliac.

Changes in the Size, Capacity, and Form of the Uterus.—Increase of the constituents of the uterus is associated with remarkable development of the organ in size and capacity. The uterus undergoes very great eccentric hypertrophy, so that at the end of pregnancy it measures, according to Spiegelberg, about twelve inches and three-quarters, 35 centimetres, in length, about nine inches and a half, 24 centimetres, in breadth, and antero-posteriorly nine inches or 23 centimetres. The late Sir James Simpson gave the following measurements of the uterus, length twelve to fifteen inches, breadth nine to ten inches, the antero-posterior measurement six to eight inches. He further stated the surface of the unimpregnated uterus is five or six square inches, and its capacity one cubic inch; but at the end of pregnancy the surface of the organ is three hundred and fifty square inches, and its capacity four hundred cubic inches. Tarnier regards the last measurement as somewhat exaggerated; Krause states the capacity is increased 519. The weight of the uterus is twenty to twenty-four times as great as in the virgin state. Spiegelberg attributed the greater size of the uterus partly to the organ being stretched by the ovum, claiming that the thickness of the walls, which increases during the first months, diminishes in the latter months so that it is less than before impregnation. Velpeau and Depaul both held that pregnancy caused no great change in the thickness of the walls, a view sustained by Charpentier; the uterine walls are thinner at the

[1] This theory of the uterine souffle has been proved erroneous.

inferior segment, thicker in the fundus and body, especially at that part where the placenta is attached, according to Naegele and Grenser. Tarnier holds that the thickness generally lessens toward the end of pregnancy, but is quite variable in different subjects, and is very unequal in different parts. It is impossible, therefore, to fix a uniform measure for the thickness of the walls of the pregnant uterus.

The uterus has different forms in the successive periods of pregnancy. During the first three months it becomes piriform instead of triangular. After three months it gradually takes the form of a flattened spheroid, and it is only in the latter part of pregnancy that it becomes ovoidal, the smaller end of the ovoid being below. Nevertheless, as remarked by Spiegelberg, the uterus is not to be regarded, especially in the latter months, as a rigid body with a constant form, for many deviations occur, the shape depending upon the woman's position, the volume of the ovum, the situation of the fœtus, the tension of the organ, and also upon its primitive formation.

Changes in the Position of the Uterus, and in the Consistence of the Uterine Walls.—Modifications in the weight and in the size of the uterus necessarily cause changes in its position. It is generally taught that in the first weeks of gestation the uterus is lower in the pelvis; and indeed a flattening of the hypogastrium caused by this descent is regarded as one of the earliest signs of pregnancy. Tarnier thinks this change far from constant; in a great number of women the fundus of the uterus from the first weeks of pregnancy passes the superior pubic margin, and the neck does not descend. However this may be, at three months the fundus is a finger's breadth or more above the pubes; at the end of the fourth month it is two inches or more, five to six centimetres, above; at five months 3.5 to 3.9 inches, nine to ten centimetres, above; the distance of the fundus above the pubes increases, becoming greatest in the first half of the ninth month, when it amounts to 8.6 to 9.4 inches, 22 to 24 centimetres. In the last two weeks there is usually a marked descent, arising from the entrance of the fœtal head, still, however, inclosed in the uterus, into the pelvic cavity. It should be remembered that in the multigravida previous relaxation of the abdominal wall permits the uterus to project further in front, and does not compel the fundus to ascend as high as does the tense abdominal wall of the primigravida. Further, in the latter the descent of the presenting part into the pelvic cavity occurs earlier. While the chief factor in producing this descent is the resistance of the abdominal wall to further encroachment of the growing uterus, yet another factor is the uterus itself, which in the primigravida is more rigid, and, according to Martel,[1] this rigidity maintains the axis of the fœtal ovoid in correspondence with the axis of the uterus, hence there is a tendency to force the lower part of the uterine ovoid into the pelvic cavity.

The uterus after ascending into the abdominal cavity in very few cases occupies a median position, for its posterior convex wall is not adapted to the convexity of the spine, and the organ therefore turns to one or the other side—to the right side in the great majority of

[1] De l'Accommodation en Obstétrique.

women. This obliquity of the uterus, probably having its cause in some condition of embryonic development, should be borne in mind in case gastro-hysterotomy is to be done. So, too, this normal latero-version may in labor retard the descent of the fœtal head, and require to be corrected by changing the position of the woman. But in addition to the usual right obliquity, there is also a partial rotation of the uterus by which the left side of the organ is thrown forward, and the right backward, a change very plainly dependent upon its embryonic development, as has been previously mentioned. This change of position causes the left side of the uterus to be more accessible in auscultation made for the purpose of hearing the uterine souffle.

The consistence of the uterine wall is greatly changed. Instead of being rigid and resisting as in the unimpregnated uterus, it becomes yielding to localized pressure from within or from without, but it is also elastic so that as soon as the pressure is removed there is complete restoration of form. As Pajot observes, this suppleness and special elasticity of the uterus are neither softness nor a flaccid condition; it is always possible to distinguish the uterus from the abdominal walls, and, on the other hand, the suppleness and elasticity contribute to maintain the normal accommodation of the fœtus, and thus avoid unfavorable presentations and positions without interfering with its active movements.

Relations of the Uterus at the End of Pregnancy.—The lower fourth of the anterior uterine wall is in relation with the posterior wall of the bladder, the remaining three-fourths is directly applied to the abdominal wall, but sometimes omentum or intestine may intervene. The fundus is in relation with the transverse colon, part of the stomach, with the anterior margin of the liver, the xyphoid cartilage, and the lower floating ribs. The ovaries and oviducts are close to the sides of the uterus at a point corresponding with the junction of the upper and middle third; this change in their position shows the remarkable development of the fundus of the uterus. Further, the right side of the uterus is in relation with the internal and external iliac vessels, with the obturator nerves, the psoas and iliacus muscles, the cœcum and the ascending colon; the left side has similar relations to bloodvessels, nerves, and muscles, and with the descending colon, instead of with the cœcum and ascending colon. The posterior wall is in relation with the rectum, the sacrum, the primitive iliacs, the sacro-vertebral angle, the omentum, the small intestines, the aorta, the vena cava, the dorsal and lumbar vertebræ, and the pillars and the posterior part of the diaphragm.

Properties of the Pregnant Uterus, Sensibility, Irritability, Contractility, Retractility.—As Pajot has said, pregnancy does not create any new property. But the properties which the uterus already possesses are increased; for example, the organ is more sensitive, and its nerves respond more readily to stimuli, or, in other words, its sensibility and irritability are greater. From its vast increase in size it is more exposed to the action of causes that affect these properties. The sensibility of the uterus varies in different subjects, and hence in some all active fœtal movements cause severe suffering, while others experience only a momentary inconvenience from such movements. The suffer-

FIG. 92.

POSITION OF THE GRAVID UTERUS NEAR TERM, AND SOME OF THE RELATIONS OF THE INTESTINES. —*a*. Gravid uterus. *d*. Ascending colon. *e*. Kidney. *ff*. Small intestine. *n*. Transverse colon. *i*. Liver. *l*. Diaphragm.

ing which is caused by fœtal movements is often different in different parts of the uterus, in one part severe, in another slight; the frequent repetition of movements referred to one part of the uterus will produce increasing distress in some cases at those parts. So, too, the irritability of the uterus is not the same in all; trivial causes in one woman will, from the great irritability of the uterus, excite contractions, and lead to abortion, while another is subjected to the greatest violence without interruption of pregnancy. Idiosyncrasy is supposed to explain cases of excessive sensibility, or of excessive irritability of the uterus; but in some instances at least the explanation is to be sought, not in a peculiar physiological, but in a positive pathological condition.

Consequent upon irritability is contractility, contraction is the response to irritation; contractility is manifested by shortening of muscular fibre followed by lengthening. The physiological irritability of the uterus is manifested by the occurrence of contractions, which become more frequent as the pregnancy approaches its end; these contractions are painless, but as they gradually merge into the contractions of labor they become more frequent and are accompanied with suffering. Contractility is a property of all the muscular tissue of the uterus, but of course is greatest in those parts of the organ where this tissue is most developed. The painless contractions of pregnancy promote the circulation of the blood in the uterine sinuses, and also assist in fixing the fœtal presentation. The manifestation of contractility in labor will be elsewhere considered.

Retractility of the uterus has been defined as a property of the muscular tissue by virtue of which the uterine walls tend to approach. It opposes distension, and is the antagonist of the elasticity which permits for the moment stretching of a part of the uterine walls. While contractility is a force manifested intermittently, retractility is constant in its action, and permanent. It restores the form of the uterus, temporarily lost by fœtal movements, or by changes of the mother's position; it keeps the uterine walls closely applied to the ovum in pregnancy, and after the detachment of the placenta it closes bleeding vessels, while during the puerperal state it prevents distension of the uterine cavity by bloodclots, and is one of the most important agents in promoting uterine involution. Contraction and retraction are two distinct modalities of muscular action; neither is a condition, but each is a manifestation of muscular force.

Changes in the Neck of the Womb.—Slight hypertrophy of the neck of the womb occurs in pregnancy; this part of the uterus is not as well supplied with blood as the body is, and is not subjected to the irritation from the growing ovum, at least until the latter weeks of pregnancy, and then the pressure of the ovum is chiefly at its upper portion, and for this reason its little increase in size.

The position of the neck depends upon the position of the womb, and therefore, as the latter ascends into the abdominal cavity, the neck is drawn up and apparently shortened. Anterior inclination of the uterus causes the cervix, unless there be marked anteflexion, to point backward to the hollow of the sacrum; lateral inclination directs the neck toward that side of the pelvis opposite to the side of the abdo-

minal cavity in which the fundus is; in primigravidæ the os uteri is usually found at the end of pregnancy quite far posteriorly and to the left of the pelvic cavity. In primigravidæ the virgin form of the neck is more distinct, that is more plainly conical, but after a time, in consequence of the accumulation of the secretion of its glands in its canal, it is spindle-shaped. In the multigravidæ it is cylindrical or expanded at its lower portion so as to be club-shaped.

Softening of the Neck.—Early in pregnancy a change in the consistence of that part of the neck adjoining the external os begins, and is manifested by the superficial tissues yielding to pressure. This softening is at first simply a continuation of that caused by the last menstruation; the softening advances regularly and slowly in the primigravida to the remaining portion of the vaginal cervix, so that, approximately, one-fourth is affected by it at four months, one-half at six, three-fourths at seven, and the remaining fourth at eight months. In the multigravida the process is more rapid, because the neck is shorter, and has been previously softened. The softening always begins below, thence passes above. It is attributed to a greater abundance of plasma, to hypertrophy and proliferation of fibre-cells, and, in the latter part of pregnancy, to blood stasis caused by the pressure of the fœtal head in the lower portion of the uterus. The sensation which the finger receives by pressing upon the softened cervix, has been compared to that which is given by similar pressure upon a piece of velvet placed upon a hard substance, at first a ready yielding to the pressure, and then a firm resistance. Softening of the neck is in the early months of pregnancy a valuable sign, which may assist in a probable diagnosis of the pregnant state.

State of the Internal and of the External Os—In primigravidæ the external orifice of the womb remains closed until the end of pregnancy. In rare instances the finger can enter it, but usually for only a short distance, and in some of these possibly the penetration has been, not by an open canal, but by making it open with pressure. In still rarer instances the cervical canal in primigravidæ may be permeable by the finger in the latter weeks of pregnancy, so that the fœtal membranes and presenting part may be touched; such cases are quite exceptional. In multigravidæ the external os is not surrounded by a regular and smooth surface, but by a structure marked with irregular fissures; the cervical canal is open to a degree in direct relation with the period of pregnancy, the finger readily passing, for example, to the middle of the cervical canal at seven months; the cavity thus entered by the finger is funnel-shaped, or the neck of the womb may be represented as a hollow cone, with its base below.

Shortening of the Neck of the Womb.—The question as to shortening of the cervix became the subject of controversy nearly two centuries ago, and in quite recent years the contention has been greater than at any previous time. De Graaf, 1671, held that the cervix remained unchanged until the end of pregnancy, and the same view was maintained by Verhegen, 1710, and Weitprecht, 1750. Roederer, 1753, asserted that expansion of the cervical canal, contributing thus to the uterine cavity, advanced regularly from above downward during preg-

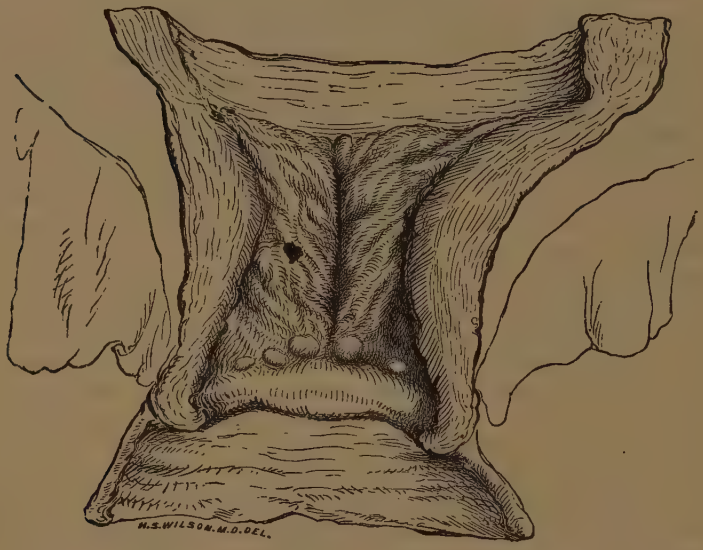
nancy, stating that this change could be noticed as early as towards the sixth month.[1] Stoltz, 1826, stated that the cervix was unchanged until the last fifteen days of pregnancy, and then the internal os opens, the cervical canal dilates from above downward, and the cervix is gradually effaced. Taylor, 1862, brought forward important observations to prove that the cervix did not shorten until the beginning of labor. In 1876, Bandl revived the teaching of Roederer, and thus arose a controversy which still continues, or rather the old controversy was revived. According to Bandl, during the last ten weeks of pregnancy, shortening of the cervix is in progress, the upper part of the cervical canal is dilated so as to form with the lower segment of the uterus the canal of Braune, or as Tarnier prefers to call it, the cervico-uterine canal. Bandl contended that the superior limit of the cervical canal, or the internal os uteri could be demonstrated at the close of pregnancy or during labor to be at the level of the pelvic inlet. According to some the inferior or lower uterine segment is formed by the dilated cervix, while others regard it as composed of the lower part of the uterine body and the dilated cervix.

Admitting the views of Bandl as to the early expansion of the upper portion of the cervical canal, Bandl's ring, which is at the pelvic entrance, and marks the boundary between the lower uterine segment and the rest of the uterus—this boundary, according to some, being the internal os uteri, but, according to others, being somewhat above that organ—all of the uterine tissue, whether belonging to neck or body below the ring, presents a much thinner wall. Müller's ring is the apparent internal os uteri, the upper limit of the cervical canal, the part above having contributed to the cavity occupied by the ovum. Bandl's views have not met with general acceptance, and probably are only the partial expression of truth. Thus, in regard to the changes of the cervix in pregnancy, Spiegelberg observed, it is no longer doubtful that the opening of the internal os uteri and the entering of the apex of the ovum into the cervical canal, thus causing this canal to contribute to the uterine cavity, are possible phenomena, and in fact do occur. Their occurrence is thus explained: In primigravidæ the lower portion of the uterus does not readily yield to the pressure of the growing ovum and to the uterine contractions, which become more frequent in the latter part of pregnancy, and hence the development of the cervical canal is more frequent in them, but the external os remains closed, or nearly so, until the end of pregnancy. But, on the other hand, in multigravidæ the lower portion of the uterus is less resisting, yields readily to the growing ovum, and therefore the internal os remains closed, not being subjected to so much pressure either from the ovum or from uterine contractions, and the finger can in these cases be passed further and further up the cervical canal with the progress of the pregnancy, the development of the canal being from below above.

1 Although Kleinwächter refers impliedly to Roederer's views as indicating that the changes occurred in the last ten weeks of pregnancy, yet upon referring to Wrisberg's edition of Roederer's Elementa Artis Obstetriciæ, 1766, the time is stated to be *versus sextem mensem*.

Fig. 93 shows no shortening of the neck, but in the last two weeks of pregnancy, according to Stoltz, Tarnier, and others, such shortening occurs in most cases; it may not be, however, until a few days, or even a few hours before labor begins. By this shortening the neck is

FIG. 93.



CERVIX FROM A WOMAN DYING IN THE EIGHTH MONTH OF PREGNANCY. (After Duncan.)

effaced, the uterine cavity and cervical canal make a common ovoidal cavity with a single opening, the external os uteri. This process is in part effected by the pressure of the growing ovum, and in part by the painless uterine contractions of pregnancy, which, towards its close, become more frequent. When the neck has thus disappeared, been effaced[1] by being taken up into the body of the womb, the uterine changes of pregnancy are completed, and labor is at hand.

Changes in the Uterine Appendages.—The broad ligaments have their peritoneal layers separated by the growing uterus, and as the organ ascends they are carried up by it; they share in the hypertrophy of the peritoneum covering the uterus. The ascension of the uterus compels a change in their direction, so that at the end of pregnancy they are vertical instead of horizontal.

The round ligaments have their thickness increased fourfold; they become much longer, and at the termination of gestation extend from the vicinity of the umbilicus to the inguinal canal on each side; in consequence of the greater development of the posterior than of the anterior wall of the uterus, they are not directly upon the sides, but

[1] Charpentier, by a strange confusion of language, as it seems to me, refers to the effacement of the neck as a phenomenon of pregnancy, but dilatation of the neck as a phenomenon of labor. But how after it is effaced can it be dilated? Dilatation of the os, but not of the neck, is a phenomenon of labor.

at the junction of the posterior four-fifths with the anterior fifth of the lateral borders of the uterus. The utero-sacral ligaments, the uterine retractors of Luschka, undergo remarkable development. The ovaries increase in size; according to Jacquemier, their size is doubled; they follow the movements of the broad ligament, and take nearly a vertical position. Ovulation in most cases, at least, is suspended, but the corpus luteum undergoes the changes which have been described as occurring in pregnancy. The oviducts also hypertrophy; their epithelial lining loses its vibratile cilia. Robin has stated that the canal of the oviduct contains a yellowish-white viscous matter, holding in suspension epithelial nuclei and fine fat granulations.

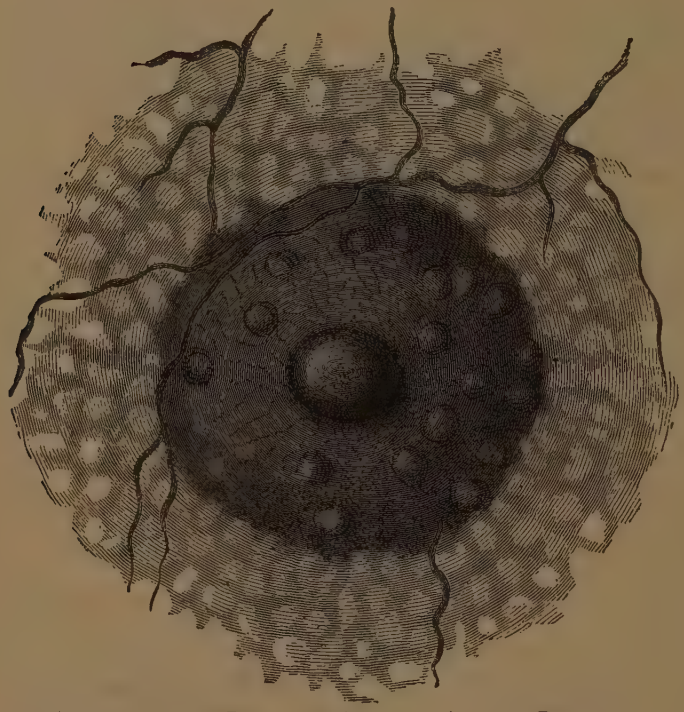
Changes in the Breasts.—In some cases the mammary glands become larger at the beginning of pregnancy, but oftener this increase in size commences at the time corresponding with the first menstrual suppression following conception. This enlargement is accompanied with greater sensibility, and occasional shooting pains are felt in them; the axillary ganglia may also be similarly affected. The superficial veins are larger and more distinct; if the increase in size of the breasts be very great, it is not unusual for striæ similar to those occurring upon the abdominal wall to be found about the fifth or sixth month. In some cases the enlargement lessens after four or five months, but again is manifest toward the end of pregnancy. The latter part of the second or third month the nipple is firmer, harder, more prominent, and sensitive; a milk-like fluid may possibly escape or be pressed from it, but this is not usually observed until in the last three months, and it may happen even in the absence of pregnancy.

Changes in the areola are more important and characteristic. These changes are swelling, development of the mamillary tubercles, and darkening of the entire surface. The first of these phenomena can usually be seen the second month; the swelling is not hard and tense, but puffy, giving to the finger the sensation of an emphysematous enlarged tissue. About the same time the areola becomes darker, and the hue deepens until the end of pregnancy, when in brunettes it is a deep brown, in some almost black, while in blondes this change is much less pronounced, and in the red-haired scarcely noticeable. The papular elevations, often called the tubercles of Montgomery, situated upon the areola, and regarded by some as miniature mammary glands, become much more prominent, projecting from the sixteenth to the eighth of an inch. The primary areola which has a radius of about an inch, three centimetres, is surrounded at the fifth or sixth month by a secondary areola; this is lighter in color, and flecked with whitish spots, presenting an appearance somewhat resembling that of dust-covered, white blotting paper upon which drops of water have been sprinkled. The illustration found on the next page (Fig. 94), from Depaul, very well represents the appearance of the breast in the latter months of pregnancy.

Multiple Pregnancy.—When the uterus contains two or more fœtuses the pregnancy is multiple. If there are two fœtuses they are twins; if three, triplets; if four, quadruplets, and if five, quintruplets, and the pregnancies receive corresponding names, double, triple, quadruple,

and quintuple. There is no established case where a woman gave birth to more than five children at one time. In order that multiple pregnancy can occur, a single ovary must furnish the necessary ovules,

FIG. 94.



APPEARANCE OF THE PRIMARY AND SECONDARY AREOLA IN PREGNANCY.

or some may come from each ovary; or, in case of twins, one ovisac may contain two ovules, or one ovule two germs, or the germ may split into two germs.

Frequency.—According to Kormann[1] double pregnancy is found once in 90 pregnancies; triple, once in 7900; and quadruple, once in 370,000. The frequency varies in different countries. Pliny stated that it was greatest in warm climates, but modern statistics do not sustain this theoretical opinion. Thus in France and in Belgium there are scarcely ten twin births in a thousand cases of labor, while in Denmark and in Sweden the proportion is between fourteen and fifteen, in Ireland between sixteen and seventeen to the thousand. It is thus evident that climate is not a factor in determining the frequency of multiple pregnancies. A remarkable difference in the proportion[2] of twin to single pregnancies is found in different Italian cities. While in Genoa there is 1 to 54, Milan 1 to 56, in Palermo the proportion is only 1 to 114. Between Genoa and Milan at one extreme, and

[1] Op. cit.

[2] De l'Obstétrique, en Italie. Millct.

Palermo at the other in regard to the relative frequency of twin pregnancies, are placed Padua, Trente, Turin, Bologna, and Naples.

Causes.—In addition to climate, race, stature, and the great development of the ovaries have been regarded as causes of pluriparous pregnancies. But, whatever influence may be attributed to any of these, the chief causes are multiparity and heredity. The statistics of Duncan show that the number of pluriparous multiparæ is about eight per cent. greater than that of pluriparous primiparæ; those of Puech show that multiparæ have triplets eight times as often as do primiparæ. Heredity seems to be a more potent cause. Female twins often give birth to twins. A woman had twin pregnancies three times, her daughter had two twin pregnancies, and her daughter in turn a twin pregnancy. Instances where this manifestation of heredity was transmitted to the male are also recorded. Leroy states that four brothers, in whose family twin pregnancies in the parents of a collateral branch had been observed, procreated twins—three of them twice each, and the fourth four times.

The cases just cited indicate that excessive fecundity, though usually belonging to the female, as a cause of multiple pregnancy may depend upon the male.

Sue mentions the case of a man whose wife gave birth to triplets seven times in seven years, and then seducing his servant girl she gave birth to triplets. Nor is the case of the Russian peasant, Feodor Wassilief, to be omitted. It was quoted by Velpeau from Merriman;[1] this peasant was married twice, and his first wife had quadruplets four times, triplets three times, twins sixteen times, in all sixty-nine children; his second wife had triplets twice, and twins six times, making her contribution only eighteen to the entire number of eighty-seven. Moreover eighty-four of these children and the father, who was then seventy-five years old, were living at the time the English merchant, whose story Merriman publishes, visited Russia.

In sixty-one cases of twin pregnancy, analyzed by Kleinwächter, the youngest mother was nineteen, the oldest forty-one years; in $67\frac{22}{100}$ the pregnancies occurred in women between twenty-three and twenty-nine years of age, a fact which does not sustain Matthew Duncan's view that "pluriparity is an unnatural or abnormal condition connected with sterility by being observed in the sterile ages, or ages of weakness or imperfection of the reproductive power."[2]

Superimpregnation.—The question naturally suggests itself as to whether the ovules which are developed in plural pregnancy, are fecundated simultaneously, or at different times. In the case of many of the pluriparous inferior animals fecundation is simultaneous; for example, the boar impregnates the sow at a single coition. So it may be in the human female, and possibly is in the majority of cases. But super-

[1] Merriman apparently believed the story, for in quoting it from the Gentleman's Magazine, 1783, he also quotes the following. "The above relation, however astonishing, may be depended upon, as it came directly from an English merchant in St. Petersburg to his relation in England, who added that the peasant was to be introduced to the Empress."

[2] Sterility in Woman.

impregnation is, arbitrarily at least, divided into super-fecundation, and super-fœtation. By the former is meant the fecundation of one or more ovules after one has been fecundated, that is successive instead of simultaneous fecundation; by superfœtation is meant fecundation effected after the uterus is occupied by the product of conception. The latter requires the occurrence of ovulation several days, weeks, or even months after the ovule was liberated which was first impregnated.

That superfecundation may occur in the human female, as well as in some of the inferior animals is certain. Thus a white woman has twins, one a mulatto, the other white; or of a black woman's twins, one is black, the other a mulatto. The only rational explanation is that in each case, each child shows a different paternity. A mare may be covered by a stallion, and at an interval varying from a few hours to fifteen days is covered by an ass; she has twins, one a horse, the other a mule. A bitch in heat is covered by different dogs, and in her litter the puppies may indicate different fathers.

But when superfecundation occurs in the human female, the fact is presupposed that the ovules impregnated are liberated from their ovisacs at the same menstrual period. Nature intended her to be uniparous, and once fecundation has occurred, ovulation[1] usually is suspended, so that the probability of superfœtation is at once opposed by a physiological reason, in other words, there is no ovule to be impregnated. This is admitted as a law; nevertheless, as claimed by some, there may be exceptions.

But there is an anatomical argument derived from the condition of the uterine cavity occupied by the developing ovum; room for the spermatozoids to pass to the ovule, and then space for the entrance of the latter into the uterus present theoretical objections. It must, however, be admitted that prior to the union of the ovular and uterine decidua, which, as has been before stated, occurs some time in the fourth month, there is no invincible anatomical obstacle to a new impregnation occurring. Nevertheless with the difficulty just mentioned, and with the physiological one arising from the suspension of ovulation during pregnancy, the improbability of the occurrence of superfœtation is very great.

The hypothesis of superfœtation is proposed, first, to explain those cases where there is simultaneous expulsion of the products of conception, one large, well-developed fœtus, and the other a small and feeble fœtus,[2] or the second product may be still in the embryonic condition. But twins usually differ in size and vital power, and this difference may be so great that the feeble one dies soon after birth; it may depend upon the fact that one was better supplied with nourish-

[1] Playfair gives the occurrence of menstruation as a proof of ovulation. Before admitting such an argument, it must first be proved that menstruation does then occur; next it must be proved that ovulation and menstruation are always necessarily connected. A woman may menstruate after her ovaries have been removed; and, according to Playfair's argument, she necessarily ovulates.

[2] In a litter of pigs it is not unusual to find one, generally the last born, smaller, feebler, and more poorly developed than any one of its brothers or sisters; it is commonly known as the runt; but farmers never adduce this fact as proof of superfœtation.

ment than the other and prospered to the detriment of its companion, or there may have been an inherent difference in the vitality of the ovules impregnated. Where one product was still embryonic, and the other well developed, the answer is the former died early in pregnancy, and remained without material change until the pregnancy ended.

But, second, the hypothesis is thought to explain the cases where several days, weeks, or, as is alleged in some cases, months intervened between the birth of twins. In some of these instances the mother was found to have a double uterus; one fœtus was contained in one-half, the other in the other half of the organ; and under such circumstances possibly a considerable interval occurred between the impregnations. But most of the cases respond to a premature labor or miscarriage with one fœtus, while the other was retained until full term or somewhat beyond.

Many of the facts adduced to prove superfœtation belong to a past age, when such marvels were more readily accepted than to-day; and as a rule they fail in the details and thoroughness of investigation necessary to establish their truth. "Few authors to-day believe in the reality of superfœtation."[1] Doléris suggests that superfecundation, that is the fecundation of several mature ovules expelled from the ovisacs at the same period, may occur within fifteen days, or at most three weeks; after about this time fecundation seems impossible.

Fœtal Appendages in Twin Pregnancies.—Where two ovules from different ovisacs are impregnated, each fœtus has its own chorion and amnion, and originally the ovular decidua of each was distinct, but the portion intervening between the two sacs is absorbed, so that they have a common decidua. The placentæ may be closely united, but there is no vascular connection; there is entire independence as to the circulation in each.

If there be a single placenta with one chorion and two amnions, either there were two germs in one ovule, or the germinal vesicle has furnished two germinal areas.[2] The bloodvessels of the twins communicate in the placenta. Either the twins are well developed, or the greater heart activity of one takes away the nourishment needed by the other, and the latter dies. The twins are of the same sex. Most rarely there are one placenta, one chorion, and one amnion. The amnion folds between the two may have been absorbed because of pressure, or the origin of the twins may have been from the division of a germ; the twins are of the same sex.

Sex, Size of Twins, Course of the Pregnancy.—In the great majority of cases twins are of the same sex, and males predominate over females. The united weights of twins at birth is usually greater than that of a single fœtus at the same period of development, but the weight of each is considerably below the mean; generally one of the twins is larger and stronger than the other. One of the children may die early in the pregnancy, and either be expelled with its appendages, and pregnancy go on; or it may be retained, the liquor amnii be ab-

[1] Doléris. [2] Kormann.

sorbed, while it undergoes the change called mummification, or be pressed against the uterine wall by the other fœtus and its membranes, so that it is flattened, making a thin mass called fœtus *papyraceus*. In other cases the condition previously mentioned as to the heart of one of the twins having greater power than that of the other may be present, and the latter fail in development, except as to the lower part of the body and lower limbs, and a monster known as *acardia* results, while the former is perfectly developed.

Abortions, hydramnios, and monstrosities are more frequent in plural than in single pregnancies; acephalous monsters are only found in the former.

Premature labor frequently occurs in twin pregnancies, its usual cause being excessive distension of the uterus. Triple pregnancies rarely, and quadruple probably never, reach the normal term.

CHAPTER IV.

THE SIGNS AND DIAGNOSIS OF PREGNANCY.

PREGNANCY is revealed by certain signs, and its diagnosis is made by the recognition and appreciation of these. It is essential that the obstetric student faithfully study and clearly understand these signs, and then, by giving to each its true value and combining all, he will reach a correct conclusion. Van Swieten said that the physician's reputation was never more imperilled than in deciding as to pregnancy: "frauds everywhere, often everywhere snares prepared for the unwary." But not only may a mistake in diagnosis be very injurious to his reputation, it may ruin the reputation of one unjustly accused of being pregnant, or risk the health, or even the life, of another affected by a disease simulating pregnancy; and this disease, thus neglected, may become incurable. That great mistakes have been made in the diagnosis of pregnancy—this condition asserted when it was absent, or denied when it was present—and that these mistakes have in some instances led to most deplorable consequences, is matter both of printed and of oral history. Few practitioners of a dozen years' experience can truthfully say, that no error in the diagnosis of pregnancy has ever been made by them. Pajot states that he could make quite a volume giving in detail the history of all the erroneous diagnoses in regard to pregnancy which have come under his own observation in an experience of thirty years; and these mistakes made, not by *sages femmes*, but by practitioners of more or less, some of them with very long, experience.

Now, there must be some reason for such great and comparatively frequent mistakes, and a brief exposition of the chief of these reasons may help to avoid their consequent errors. Socrates said "to attain to a knowledge of ourselves we must banish prejudice, passion, and sloth." These, too, must be banished when we study the practical diagnosis of pregnancy. We must investigate a case without prejudice —that is, without *prejudgment*—whether the prejudice be from the opinions of others, or from the subject's previous history and her surroundings. That the judgment of another is in favor of or adverse to pregnancy must not rule our own; nor should our opinion be biased by the social position, reputation, and circumstances of the party; for some women, around whom apparently every safeguard has been thrown, may sacrifice their virtue, while others, less protected, preserve it in the midst of the strongest temptations. In this judicial inquiry the woman must be divested of all the accidents of life, of all her artificial surroundings, and simply considered as capable of reproduction. Her statements are to be received with great caution, for, on the one

hand, a strong imagination will beget in her, if she ardently desire to be a mother, some of the signs of pregnancy; or, if she wishes to deceive, she may assert them, and, if she wishes to conceal, she may deny them—yea, many a woman in the agony of childbirth, or in the very article of death, has denied her pregnancy out of regard for her own reputation, or, more frequently, for the purpose of saving her seducer from exposure.

Ambition to give a prompt decision, or pride in opposing that of another, may lead to error. Rapidity is very far from proving correctness of diagnosis; here, as Lord Bacon has said of another matter, our intellects need not wings but weights of lead to moderate their course. The man of greatest knowledge least exalts his attainments, and is the most cautious and deliberate in judgment, and has respect for the opinions of others. Sloth may hinder or prevent our thorough investigation. We may be satisfied with a few facts instead of seeking all that are available. We may give undue weight to one or more of these facts, undervaluing or neglecting others. In illustration some cases that have been under my own observation will be given: A young lady of high social position, and against whose purity there was no whisper or thought of scandal, is attacked with obstinate vomiting. There is a denial of menstrual derangement; the vomiting resists all remedies, and she dies, but while dying a fœtus of three months and a half is expelled. A woman having passed twenty years of married life childless, some months after the menopause becomes pregnant; the pregnancy is suspected by one attendant, and denied by another. A girl who has never menstruated, and who does not fully present the other signs of puberty, becomes pregnant by violence, and gives birth to a child when she is twelve years old. A woman has menstrual suppression, coincident abdominal enlargement, the mammary and many other signs of pregnancy; but a post-mortem examination proves cystic disease of the ovary. A girl of twenty has never menstruated; her abdomen enlarges, her breasts are swelled and secrete; after a time severe uterine contractions occur, and a physician of large experience called to her during this attack declares she is in labor; the cause of the abdominal enlargement is accumulation of many months' menstrual secretion, and the uterine contractions simulating labor-pains are the efforts to overcome the resistance of an imperforate hymen.

Time would fail to give all the *published* cases where a pregnant uterus has been tapped, or even abdominal section made for its removal, because it was thought an ovarian tumor, and many a patient has been saved from such perils because of the postponement of the operation until happily labor prevented its performance; the unpublished instances of such errors are doubtless much more numerous.

Pajot[1] states that he has seen a pregnancy of four months taken for an abscess, and the uterus opened by a bistoury, introduced into the vagina, by one of his old masters, the most learned and venerated. But it is not necessary to multiply instances of wrong diagnoses leading to

[1] Travaux d'Obstétrique et de Gynécologie.

an assertion of pregnancy when it does not exist, or a denial of it where it is present. Tardieu[1] has said that all the signs of true pregnancy, except the *bruit* of the fœtal heart, may be observed when there is no pregnancy, from the development of the abdomen and breasts up to movements and the efforts of labor. It is not wonderful then that mistakes have been made, and yet in most cases they are avoidable.

Liability to error is caused by the pregnancy being abnormal, or by its complication with some pathological enlargement, as from ascites, ovarian tumor, or uterine fibroid, but these topics will be considered elsewhere. Concluding the subject of diagnostic errors as to pregnancy, the practitioner who would avoid them must faithfully interrogate all the changes, both organic and functional, in the maternal organism, and those which are caused by fœtal development; he must be patient, thorough, painstaking in his investigation, not hasty, partial, and superficial; he must be willing to delay his decision in all doubtful cases, rather than run the risk of a happy guess, or trust an average of probabilities. Many other errors in diagnosis may never come to the light, but time is the certain and remorseless revealer of these; alike the asserted pregnancy which, like the weaving of Penelope's web, never ends, and the denied pregnancy which in a few weeks or months a babe's first cry contradicts, are too often made known to the disappointment if not disgrace of the hasty diagnostician.

Classification of the Signs of Pregnancy.—These may be conveniently divided into the *subjective* and the *objective*. The former include the information we can get from the person herself, all the answers she makes to our inquiries as to the functional changes caused by pregnancy, as to her own sensations and knowledge. By objective signs we mean those discovered by our own senses, the special avenues of certain knowledge; we may, or we may not, believe what another tells us, but that which we see with our own eyes, hear with our own ears, and handle with our own hands commands our credence. The subjective signs will be considered first.

Menstruation is Absent.—The absence of menstruation is a sign of great value in the case of a woman hitherto regular, there being no pathological cause for the suppression, and no pathological result from it; the sign increases in value each month that it continues. But conception may occur during lactation, in the first nine or ten months of which menstruation is normally absent, or it may take place before any flow has been observed; as La Motte said, a woman may have fruit before flowers, in such cases of course the sign is without value. Again, a monthly flow may occur once or oftener after conception, even continue during the entire pregnancy; and, stranger still, are those rare cases where this hemorrhage is alleged to have taken place in women only when pregnant. Naegele and Grenser,[2] referring to menstruation in pregnancy, state that sometimes the flow does not differ in type, quality, and quantity from ordinary menstruation. But the general law is that the pregnant woman does not menstruate, and

[1] Sur les Grossesses Fausses et Simulées.

[2] Traité Pratique de l'Art des Accouchements. Translated by Aubenas, Paris, 1880.

the apparent exceptions to this law are very few. Nature, when building up the fœtus, has no excess of material to be periodically discharged, and the intimate union which is established early in pregnancy between the ovum and the uterine mucous membrane, prevents the latter being normally a source of hemorrhage whether irregular or periodical. Further, ovulation is, as a rule, absent in pregnancy, and in like manner the associated or resulting hemorrhage ought to be absent. Hemorrhages from the uterus of a pregnant woman are pathological, not physiological, and generally threaten abortion or premature labor, and should be so considered, and so treated. Rarely will one be deceived, says Stolz,[1] who regards a woman menstruating regularly, with all the characters of menstruation, as not pregnant, while trusting the contrary opinion he is exposed to frequent errors.

Nausea and Vomiting—Salivation.—Gastric disturbance is one of the most frequent symptoms of pregnancy, and in rare cases it begins about the time of conception. As illustrating the last statement, the following report of a case by the late Dr. Montgomery is of interest: "I attended a patient who was married on Monday, and began to be squeamish on Saturday; her delivery took place within nine months." If the nausea and vomiting be associated with menstrual suppression, if the disturbance occur at a regular time each day without any other pathological symptom, and if food is vomited soon after it is taken, and the appetite is unimpaired, this sign has great value. Copious secretion of saliva occurs in some cases, but it is not very frequent; it generally accompanies excessive nausea and vomiting, though it may also occur where these symptoms are not marked. The late Dr. Dewees attached great importance to spitting a white, frothy mucus—"cotton spitting"—as a sign of pregnancy.

Nervous Disorders.—Changes in the disposition, increased sensibility, despondency, etc., are of no value as signs of pregnancy, "for they are often just as great when a woman believes herself pregnant," the event proving her mistake, as when she is pregnant. The different forms of neuralgia from which pregnant women sometimes suffer may occcur to the non-pregnant.

Mammary Pains and Swelling.—Pains in the breasts and some enlargement of these organs, with possibly a slight secretion, will probably be observed by most women early in pregnancy, but all these symptoms may occur in girls and women who are not pregnant. Many females have more or less mammary pain and swelling in connection with menstruation.

Irritability of the Bladder—Leucorrhœa.—It is not uncommon for women in the first part of gestation to have some irritability of the bladder, and increased mucous discharge from the sexual organs. While inquiry may be made concerning these symptoms, but little importance is to be attached to them alone, for there are so many other conditions in which they may be found.

Quickening.—Certain sensations perceived by the mother were believed to mark the time when the fœtus was endued with life and soul, and the woman was then "*quick* with child;" this distinction was

[1] Op. cit.

recognized alike by physicians and by courts. We now know that the child's life begins with the union of spermatozoid and ovule; then and there was the quickening power, then the true creation, and the young life in its dim dawn is as real and sacred as in its maturity.

The phenomenon commonly called quickening usually occurs between the first and the middle of the fifth month, but in rare cases it is noticed earlier, in others later, and in still others it is absent during the entire pregnancy.

Different opinions have been held as to its cause. By some it is attributed to the direct contact of the uterus with the abdominal wall. Tyler Smith believed the sensations due to the first peristaltic actions of the uterus, and regarded the date of quickening as marking the time when the contractile tissue of this organ is so far developed as to admit of these contractions. The opinion generally received is that it is caused by the movements of the fœtus that are first recognized by the mother; they are not felt until the uterus rests upon the abdominal wall, and they are felt through it, and not immediately in the wall of the uterus. Of course, fœtal movements are made much earlier, and they can be recognized by the stethoscope before the mother is conscious of them. The value of this sign of pregnancy is lessened not only by the fact previously mentioned, that pregnancy may be completed without the mother ever having been conscious of them, but by this, that, as Hamilton said, no woman ever yet fancied herself pregnant without persuading herself she felt the movements of the child. Nay more, a woman after repeated experience as to the sensation in question may, with the best faith in the world, assert she feels these movements, and yet not be pregnant. Dr. Blundell[1] mentions a case under his own care where a woman who had given birth to twelve children believed herself again pregnant, declaring she felt the movements of the child as plainly as she had in any of her previous pregnancies, and yet she was not pregnant.

The story of the supposed pregnancy of Queen Mary, of England, and that of Joanna Southcote, furnish illustrious instances of self-deception in regard to the sensation of fœtal movements.

Objective Signs.—These are sought, not by inquiries, but by direct examination of the patient; they are not her statements, but facts and conditions immediately recognized by our own senses.

Inspection.—We observe the patient's countenance as to whether anxious, haggard, expressive of suspicion, or indifference; her face as to whether full and florid, or pale, thin, and emaciated, and as to the presence or absence of discolorations. When the patient is standing or walking it is well to notice the position of the shoulders, the dorsal curve, and the abdominal prominence. Examination of the naked abdomen may show striæ and pigmentation, and changes in the umbilicus, a deeper or effaced cavity, or umbilical pouting. The labia majora may be found swelled and firmer, and presenting greater or less discoloration, and the vaginal mucous membrane purplish in hue. Nevertheless, visual examination of these parts is not necessary in most cases of supposed pregnancy. Exposure of one of the mammary

[1] Principles and Practice of Obstetricy.

glands is less trying to the subject, and furnishes more important information. Is the breast larger and firmer than usual? Is the nipple more prominent and harder, and can a fluid be pressed from it? The areola is to be closely observed as to whether swelled and darkened, and as to hypertrophy of its tubercles; supposing the primary areola to have undergone the characteristic changes of pregnancy, if the gestation has lasted five months, the secondary areola is beginning to appear. The urine may be examined as to the presence of kyestine, or as to the lessened quantity of its solid constituents; but such examination is of scientific interest rather than of practical value. Jorissenne's "sign" may be tried, the pulse counted when the woman is standing, then sitting, and, finally, when lying.[1]

Touch.—The obstetric definition of touch is a digital or manual examination of the female internal and external generative organs and adjacent parts, for diagnostic or therapeutic purposes. Touch may be vaginal, rectal, vesical, or abdominal. In the first three it is almost always digital, but in the last it is usually manual, and commonly called palpation; sometimes vaginal touch and abdominal palpation are combined, and this is bi-manual, or abdomino-vaginal examination.

Vaginal Touch.—This is usually made with the index-finger of the right or of the left hand, whichever may be the more convenient with reference to the position of the patient; while the right hand is generally used, there are, as Cazeaux has said, some diseases of women and some positions of the fœtus which compel the accoucheur to use the left hand, and therefore he should accustom himself to touching with either hand. Some practitioners prefer to join the medius to the index, thereby gaining, according to Stein, a little more than half an inch, 15 millimetres; a gain of an inch is impossible. But if two fingers are used the examination may be quite painful in the primigravidæ, and the sensation given the examiner by two fingers is less clear than that from one; beside, the index can be more easily separated from the adjoining finger, and thus can explore a greater part of the pelvic cavity.

Hubert, who happily characterizes the accoucheur's finger *clairvoyant*,[2] states that in some localities in Holland accoucheurs and *sages-femmes* have for their sign a representation of a long finger surmounted by an eye. A similar device was placed by the late Dr. Valentine Mott upon the tickets of admission to his lectures in the University of New York.

The practitioner must carefully notice whether there is the slightest abrasion upon the finger used in touching, or upon the other fingers

[1] Jorissenne (Nouveau Signe de la Grossesse) states that in the first months of gestation, in the absence or uncertainty of other signs of the pregnant condition, an important one is furnished by the fact that the pulse does not correspond with the changes of position, but remains the same whether the person is erect, sitting, or lying down. Fry (American Journal of Obstetrics, 1884) has not found this sign of any value. More recently and from quite extensive observations, Louge (Le Pouls Puerpéral Physiologique) found the sign only occasionally present, and then after the fifth month when other signs of pregnancy generally make the diagnosis quite easy.

Fry regards (op. cit.) a vaginal temperature .7° above that of the axilla as presumptive of pregnancy, if there is no fever or local disease.

[2] Cours d'Accouchements, professé a l'Universitié Catholique de Louvain, 1878.

of the hand, and if there be he should cover the abraded part with collodion or other protective material; if he neglect this precaution he may, even from a patient in regard to whom he has not the slightest suspicion of such disease, be inoculated with the poison of syphilis; many a physician in the discharge of his obstetric duties has become the subject of syphilitic infection from not taking proper precautions in a vaginal examination. The hands should be washed in warm water, especially if they are cold, not only for the sake of cleanliness, but to increase the delicacy of touch. The finger should be covered with vaseline, oil, lard, or some simple ointment, or, better than any of these, fine soap, in order to facilitate its introduction, and make that introduction painless. The patient should be prepared by having the bowels and bladder recently emptied, and her clothing quite loose. The examination may be made when she is standing or when she is lying. If it be made in the former position, her back should be against the wall or some high, firm body, and the physician faces her, either sitting upon a low stool or resting one knee upon the floor—the right knee if the left index finger is used—the other knee furnishing a support for the elbow of the hand which touches. In the erect position the pressure of the intestines, and the contraction of the abdominal muscles force the uterus somewhat lower; hence, in some women who are very fat, it is difficult to reach the os uteri if they are lying, and the examination may have to be made in the former position; so, too, this position is more favorable for vaginal ballottement. But in most cases the examination is made when the patient is lying. She should be on her back, lightly covered, the thighs and knees flexed; the bed should be of such firm material that her hips will not sink in it, or they should be raised by placing under them three or four thicknesses of blanket or a hair cushion. The physician now takes his seat or kneels by that side of the bed nearest which the patient is—if it be the right side his right hand is used in the examination—extends the thumb and index finger, flexes the others, and introduces the hand under the clothes of the bed and of the patient, touching the middle of the inner surface of the knee next him with the extended thumb, then by following a line parallel with, and equidistant from the thighs, his finger readily finds the vulvar orifice, or this may be entered by first carrying the hand directly to the perineum, and then slightly raising the finger in the median line. Whichever plan of reaching the vulvar opening is followed, it is very much better, the examination is easier, and the movements of the finger more free, if the forearm, instead of crossing beneath the thigh, is introduced under the clothing so far as to lie in a longitudinal direction. Many obstetricians advise passing the hand over the thigh of the patient, but this practice does not so well secure her immobility and relaxation of the abdominal wall; the latter is an important point if one failing to reach the os uteri, for example, or other part of which exploration is desirable, wishes to press, with his other hand upon the abdomen, the uterus toward the pelvic cavity. Before the finger is passed into the vagina, the condition of the vulva may be learned, especially as to swelling from œdema, varices, or inflammation; it may be necessary subsequently to examine with the eye in

case he finds such conditions. When the finger is passed into the vagina, the state of this organ should be carefully noted, its size, temperature, secretion, sensibility, and form. Next, the examination of the pelvis and uterus is made. Of course any considerable encroachment upon the pelvic diameters by a new growth, or by change in the bones would be readily ascertained. Such pathological growths and deformities are rare exceptions, and the physician's constant and generally only concern is the condition of the uterus. His first effort is to find the os uteri, and this is not in all cases easy to do. Remembering the usual right antero-lateral position of the body of the uterus in pregnancy, the os would be directed backward to the sacral cavity, and to the left side; it may be impossible to reach it while the patient is lying upon her back, nevertheless a trial may be made, first having her hips still more elevated, and by pressing, with one hand upon the abdomen, the uterus backward and toward the median line; if this should fail, the woman is directed to turn upon the side opposite to that of the latero-version, the finger during this change of position being retained in the vagina, and generally the os uteri may then be felt. The changes in the cervix and os caused by pregnancy have previously been stated, and therefore no further reference to them is necessary.

Examination of the body of the uterus, as far as it can be reached by the finger in the vagina, assisted by pressure upon the abdomen, is made if the organ has changed its form so that the finger passes somewhat abruptly from the nearly cylindrical cervix to a round, expanded body, and if its walls are elastic, depressible, and yielding, the probability is the uterine enlargement is caused by pregnancy. This sign is one of the earliest that is available, and one which, if not deserving to be ranked among the certain signs, yet gives a high degree of probability.[1]

A notable softening of the portion of the uterine body situated immediately above the utero-sacral ligaments, is regarded by Hegar as a certain sign of pregnancy available in the early months. In order to ascertain this condition rectal touch must be combined with abdominal palpation; with a finger in the rectum there will be felt upon exploring the posterior wall of the uterus an elastic, yielding part situated between two harder, more resisting portions, one of the latter being the uterine neck, the other being the upper portion of the body of the uterus above the relaxed yielding portion.

Ballottement.—In obstetrics this word means the sensation which the examiner experiences when he communicates a sudden movement to the whole, or to a part of the fœtus; re-percussion is sometimes used as a synonym. It is the result of a momentary displacement of a solid body in a liquid, just as one by striking a lump of ice[2] in a

[1] Before attempting the certain diagnosis of pregnancy in the first months, it may be well to recall the caution which Dr. Wm. Hunter manifested: "I cannot determine at four months; I am afraid of myself at five months; but when six or seven months are over, I urge an examination." Of course this is extreme, for it is only in exceptional cases that a positive diagnosis cannot be made in the fifth month.

[2] Tarnier.

tumbler of water with the finger causes it to recede, and the experiment would be the same if the finger-tap were made through a membrane fastened over the tumbler, so an impulsion is made the fœtus or a part of it. If the entire fœtus be displaced, and the finger be retained at the point where this movement was produced, the return of the fœtus may also be recognized, and the sensation thus caused is known as the *choc de retour*. It is thus seen that there may be a single sensation experienced in ballottement, and this is the more frequent, or a double sensation.

Ballottement is either abdominal or vaginal; the former will be considered hereafter. In vaginal ballottement the woman is either standing or lying. The physician should, in the latter case, pass one or two fingers into the vagina, and in front of the cervix until they rest upon the body of the womb at its junction with the former; the free hand is applied to the fundus of the uterus, and then a quick movement is made by the finger or fingers in the vagina, a sudden impulse communicated by it to the fœtus, dislodging the latter from its position, and causing it to float upward in the uterine cavity; the return of the fœtus may be felt in many cases, that is unless this return be very gradual, or in those cases where only a part of the fœtus has been displaced. If the woman be lying, it is well for her to have the head and shoulders somewhat raised, so as to throw the uterus forward, and then the ballottement may be sought just as if she were erect; if she be quite horizontal the finger may be passed into the posterior, instead of into the anterior cul-de-sac.

Ballottement is an almost positive proof of pregnancy; nevertheless, Pajot found it present when the woman was not pregnant, but had a multilocular ovarian cyst. The absence of ballottement does not prove that a woman is not pregnant, for great size, or small size of the fœtus, multiple pregnancy, hydramnios, placental, or shoulder-presentation may prevent it. A ballottement caused by entire displacement of the fœtus is best perceived in the sixth and seventh months, though recognizable at about five months, and that from a partial displacement later. But before the date when ballottement is readily done, signs of pregnancy are available which are certain.

Rectal and Vesical Touch.—Rectal touch may be necessary in case of vulvar or of vaginal obstruction, in posterior displacements of the uterus, and in the diagnosis of tumors of the recto-vaginal wall, of effusions in Douglas's cul-de-sac, and of extra-uterine pregnancy. It is a method of examination very repulsive to the subject, and is rarely necessary. Vesical touch, or examination through the bladder, the urethra having been previously dilated to admit the finger, is still more rarely required.

Abdominal Touch, or Palpation.—This consists in the application of the hands to the abdomen for the diagnosis of pregnancy, and its duration, to ascertain whether it be single, or multiple, the presentation and position of the fœtus, and for the correction of an unfavorable presentation.

The woman, her bowels and bladder having previously been evacuated, lies upon her back, with her limbs extended; the abdomen is

exposed from the epigastrium to the mons veneris. The physician, having previously warmed his hands if they are cold, takes his position at that side of the bed nearest which she is lying—the left is the better—and places one of his hands upon the hypogastrium, keeping it pressed there flat and with moderate firmness for two or three minutes in order to accustom the abdominal muscles to this contact, and thus obviate their contraction. So, too, if the pregnancy be well advanced uterine contraction may be excited by the hand; during it all pressure should cease. The first object in palpation is to learn the presence and the size of the uterus, and to do this let the left hand, if the physician is upon the patient's right side, be pressed with the fingers and thumb slightly flexed so as to correspond to the convex surface of the uterus upon the hypogastrium, and gradually carry the hand farther up the abdominal wall, each movement of ascent marked, first, by relaxed, then increased pressure, and the pressure being stronger at the ulnar margin of the hand so that when the fundus of the uterus is reached that part at once recognizes the failure of resistance, and dips deeper in the abdominal cavity. Another method is by using both

FIG. 95.

THE HAND CIRCUMSCRIBING THE FUNDUS OF THE UTERUS IN PALPATION.

hands held almost vertically so that the fingers begin pressing upon the hypogastrium in the median line, then the hands are gradually separated, the space widened between them until the fingers meeting with no resistance may be passed down on each side of the uterus; the sides of the uterus can now be followed up until the fundus is reached. We recognize the uterus by its form, by its position, and possibly by its being the seat of intermittent contractions; further, in cases of doubt, while one

hand circumscribes the supposed fundus, a finger of the other may be passed into the vagina, so as to touch the cervix, and the continuity of this with the mass felt through the abdominal wall can easily be ascertained. The distance of the fundus above the pubic symphysis, supposing the woman to be pregnant, enables an approximate determination of the time of the pregnancy.

Intermittent contractions of the uterus ascertained by palpation have been especially studied by Dr. Braxton Hicks, and he states that this sign is available by the last of the third month.[1] "If then the uterus be examined without friction or any pressure beyond that necessary for full contact of the hand continuously over a period of from five to twenty minutes, it will be noticed to become firm if relaxed at first, and more or less flaccid if it be firm at first. It is seldom that so long an interval occurs as that of twenty minutes; most frequently it occurs every five or ten minutes, sometimes even twice in five minutes. However, in some cases, I have found only one contraction in thirty minutes. The duration of each contraction is generally not long, ordinarily it lasts from two to five minutes."

Dr. Hicks has more recently stated,[2] referring to this method of examination: "If we find a tumor changing in density and hardness, we have an assurance that it is the uterus." But Tarnier has called attention to the fact that a distended bladder gives the same sensation of intermittent contractions, and the experience of others can give confirming proofs; so, too, according to Duncan, contractions quite as distinct may be observed in case of a soft fibroid of the uterus, and with as much change of shape as a pregnant uterus: the first source of error would, of course, be readily avoided by the use of the catheter.

At five months the walls of the uterus have become so elastic and depressible, and the fœtus is sufficiently developed to be recognized by palpation if the abdominal wall be not too thick; in this examination some parts of the uterine globe are harder, more resisting than others which are elastic, and permit depression. As pregnancy advances an indistinct fluctuation may be found, and if the uterus is embraced by the hands at its sides, by pressing these alternately, the fœtus, or parts of it, may be moved towards one, and then towards the other. The sensation experienced in thus communicating a movement to the fœtus is called abdominal ballottement.

Passive movement of the fœtus may also be made by pressing with a single hand upon some portion of the uterine globe where there is felt a special resistance, that resistance coming from part of the fœtus, and the pressure forcing it momentarily away.

Spontaneous movements of the fœtus are almost certain to occur during abdominal palpation; when they are being made the hand should be kept immobile, but closely applied to the abdominal wall. These movements may be recognized as early as the last of the fifth or the first of the sixth month. They may be general or partial; in

[1] Transactions of the London Obstetrical Society, vol. xiii.
[2] Transactions of the International Medical Congress, 1881.

the former case the entire body changes its position, and a general change in the form of the uterus temporarily occurs; the movement is gradual, gliding, or rolling, and is slow. The partial movements are those of the head, or of the members; they are quick, local, as if of sudden taps or blows given at parts of the internal uterine wall, and causing that part to change for an instant its form.

Active movements of the fœtus are most frequently observed in the morning after the woman's rest, at least they are then most pronounced. Of course, if the obstetrician recognizes such movements, he has not only positive proof of pregnancy, but also of the fœtus being alive. But the inability to recognize these movements, or their absence, is not a proof that the woman is not pregnant; for the feebleness of the child, or excess of liquor amnii, may cause this sign to be absent. Or, again, contractions of the abdominal muscles, or movements of the intestines, may be mistaken, and have been so mistaken by even celebrated observers, for movements of the fœtus. He therefore will act most wisely who avoids possibility of error by repeating once or oftener this examination, and also confirms the results obtained by touch by those given by sight—that is, both feels and sees the movements of the fœtus. It is, moreover, fortunate that he is not restricted in deciding as to pregnancy by a single sign, but can combine others with it.

In many cases at the end of the sixth or the beginning of the seventh month different parts of the fœtus, as the head, breech, or limbs, may be recognized by abdominal palpation. Nevertheless a tense, resisting abdominal wall, or one that is very thick, may render this recognition impossible.

The late Dr. Albert H. Smith,[1] of Philadelphia, advised in certain cases the following method of "external bi-manual ballottement:" The woman is placed upon the edge of the bed with her clothing removed from the abdomen, and then rolled upon her side so that the anterior abdominal wall projects over the edge of the bed; then the rotation of her body is carried still farther until the enlarged uterus becomes so dependent that it may be supported by the hand placed beneath it, while the other hand makes counter-pressure upon the opposite side of the uterine mass. Thus let the woman be upon her left side, the right side, therefore, being above, the examiner takes his seat with his face toward her head, his left side being toward the pendent abdominal mass, but about opposite the hips. The right hand is then passed far under the uterus as it projects over the bed, the palmar surface being in contact with the abdominal integument and the ulnar edge toward the iliac bone. The left hand is thus placed similarly upon the right side of the abdomen, making counter-pressure upon the opposite side of the uterine body so as to grasp it between the two palms. This gives a full command of the tumor, and enables the examiner to appreciate the shape and density of the mass, its fluctuating character, and

[1] "Manual Examination in the Diagnosis of Pregnancy." A paper read before the Philadelphia County Medical Society.

the movement of a separate body within it, which can be operated upon by manipulation and re-percussion." Dr. Smith further states that by this method he has been "able to diagnose a pregnancy of six months when the fœtal heart was entirely inaudible."

In another part of this paper its author stated that even at three months and a half it is sometimes possible, if the uterine wall be thin and soft, to feel the movements of the child by a finger pressing firmly upon the uterus posteriorly to the neck, while the other hand makes counter-pressure through the abdominal wall upon the anterior and the superior surface of the uterus; and further, "by a gentle thrust of the vaginal finger upward, to feel the receding and return of a body loosely floating in a liquid;" during this abdomino-vaginal manipulation the woman is lying upon her back.

Obstetric Auscultation.—Laennec's treatise upon Mediate Auscultation was published in 1816, and two years later Mayor, of Geneva, stated that upon applying the ear to the abdomen of a pregnant woman the pulsations of the fœtal heart could be heard, and he thus made known one of the most important discoveries in obstetric science. Kergaradec, of Lausanne, ignorant of Mayor's priority in the discovery, announced the same fact in 1821. The discovery was an accident to each; neither was listening for what he heard; Mayor listened hoping to hear sounds caused by movements of the fœtus, and Kergaradec those occurring in the amniotic liquor from these movements.

Kergaradec, in addition to hearing the pulsations of the fœtal heart, heard a sound attributed by him to the circulation in the placenta, which he therefore called the placental souffle. As will be shown hereafter, his theory of the origin of this souffle was erroneous; the souffle is not connected with the placental circulation, and therefore the name given it was not correct.

In addition to the two sounds mentioned, other sounds are discovered by obstetric auscultation: those caused by fœtal movements, a cardiac souffle, attributed to the passage of blood through the foramen of Botal, and a funic souffle, which is thought to result from compression of the umbilical cord; but they are of minor interest, and the two sounds first discovered are of prime importance, and therefore only will be considered.

Obstetric auscultation is usually abdominal, but it may be vaginal; Nauche, at the suggestion of Maygrier, devised an instrument called the metroscope for auscultating through the vagina. The objections to vaginal auscultation are its difficulty, the unwillingness of patients to submit to it, and when the instrument is applied to the fundus of the vagina, or in the cavity of the uterine cervix, great irritation, causing abortion, may be produced. Nevertheless it has recently been revived by Verardini, of Bologna, who by this means has been quite successful in diagnosing early pregnancies. Abdominal auscultation should be mediate for these reasons: The direct application of the ear to the abdomen is indelicate; pressure upon a great extent of surface, causing *bruits* from muscular contraction, is necessary; it demands a constrained position on the part of the observer, and it is not possible

thus to auscultate some parts of the abdomen, and the want of cleanliness on the part of some patients makes it very objectionable. A stethoscope is less trying to the patient and to the doctor; it permits examination of parts that cannot be reached by the unarmed ear, and the sounds heard through it are better defined, and their limit better determined. The stethoscope should not be less than six inches, about 15 centimetres, long. The woman should lie upon her back, with her limbs extended, or only slightly flexed. In the course of the examination it may sometimes be necessary for her to turn upon one or upon the other side, but the chief examination will be made without change of position. In some cases, from motives of delicacy, the abdomen may be kept covered, and a single thickness of thin unstarched material will not usually materially interfere with hearing the sounds sought; but, as Depaul remarked, in all cases of doubt or difficulty the abdomen must be naked.

Uterine Souffle.—Upon applying the stethoscope to the abdomen of a woman some five or six months pregnant, or more, probably the first sound which will be heard is that which was originally called the *placental souffle*, and which some physicians of to-day still thus miscall; it is properly termed the *uterine souffle*. That the placenta has nothing to do with the production of the sound in question is proved by the fact that it may be heard two or three—in some cases five or six—days after labor. Since this souffle may be heard several days after labor, it is plain that when heard during pregnancy the place where most distinct gives no indication as to the site of placental attachment. Beside the placental theory of this sound, it has been attributed to an impoverished condition of the blood, to pressure of the gravid uterus upon the iliac arteries and upon the aorta, more recently by Glenard at first to the circulation in the epigastric, and then to that in the "puerperal" artery.

The theory of its origin which is now most generally accepted is that of Dubois, somewhat modified by Depaul.[1] The sound is heard most distinctly at the sides of the uterus where the blood-supply of the organ is received; the arteries upon entering the uterus immediately dilate, offering permanently a capacity which seems too great for the blood they have to receive. This disproportion, which does not naturally exist in other parts of the organ, may nevertheless be produced under the influence of different causes whose action is transient, and varying from one minute to another. Among these causes the most common are those which result from compressions caused by projections of different parts of the fœtal ovoid. Thus it happens in correspondence with these changes, there are changes in the uterine souffle, which may be heard distinctly one minute at a particular part of the uterus, and then instantly cease. The sound is single, without shock, is synchronous with the mother's pulse, and resembles the souffle of a varicose aneurism; it varies in character, and in distinctness, it may be sibilant, or humming, or sonorous; it has been compared to the sound made by saying in a low tone *voo*. It is best heard when the stetho-

[1] Dictionnaire Encyclopédique des Sciences Médicales.

scope is applied to the lower lateral parts of the uterus; it is usually first recognized in the fifth month, but Depaul heard it in the tenth week, Spiegelberg from the eighth to the ninth, as did also Verardini.

From the explanation that has been given of the cause of this sound, it can readily be understood that whenever the uterus has a notably increased supply of blood, the uterine souffle may be heard; thus it has been found in some cases of uterine fibroids. As a sign of pregnancy, therefore, it has little value; taken in connection with others it adds strength, but must not be relied upon alone. Even if the pregnant state be known, this sound gives no information as to the condition of the fœtus; the death of the fœtus makes no change in the souffle.

Sounds of the Fœtal Heart.—These sounds have been very generally compared to the *tic-tac* of a watch put under a pillow upon which the ear is placed. The first sound is the more distinct, and corresponds with the pulsation in the umbilical arteries; the interval between the two sounds is less than that between the double pulsations, or, as one may say, it is twice as long between a *tac* and a *tic* as it is between a *tic* and a *tac*, and this difference may be thus expressed, *tic-tac—tic-tac.*

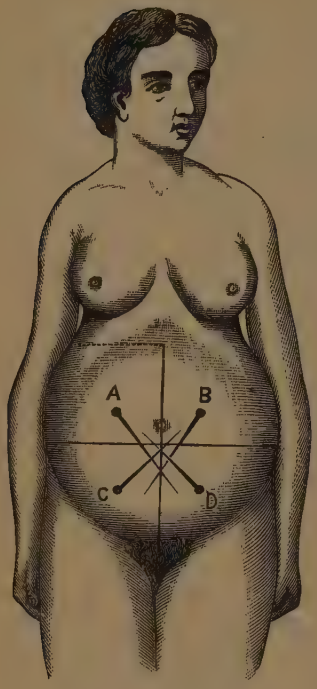
Depaul in several cases heard these sounds at three months and a half, and in one at the latter part of the third month.[1] "At the end of the fourth month the cases where auscultation is uselessly practised are much more rare, and they become so much more exceptional as women are nearer the term." In 906 pregnant women examined by Depaul, the sound of the fœtal heart failed to be heard but eight times, and some of these failures, he states, are to be attributed to another cause than the powerlessness of auscultation.

In listening for these sounds the stethoscope should be applied up to four months to the fundus of the uterus, and in a line corresponding with the axis of the inlet. With the ascension of the uterus in the abdominal cavity, the instrument must usually be placed upon one or the other side, though sometimes the sounds are more distinct in the median line. During the last three months of pregnancy the sounds are, in the great majority of cases, most distinctly heard at the middle of a line drawn from the umbilicus to the left anterior superior spinous process; failing to hear them here, the physician should next listen at a corresponding point upon the right side; if the sounds cannot be heard at either of these points, the stethoscope should be applied above the umbilicus, upon one, then, if necessary, upon the other side of the median line. The illustration upon the next page, from Depaul's *Clinique Obstétricale*, shows these different points. The examiner first applies his stethoscope at *D*; if he fails to hear the sounds at this point, or hears them only indistinctly, he next listens at *C*; finally, he tries the points *A* and *B*, if no satisfactory result has been obtained by auscultating at *D* or *C*.

The pulsations of the fœtal, are much more frequent than those of the maternal heart, and vary from 120 to 160 a minute, the mean be-

[1] Depaul, op. cit.

Fig. 96.



Diagnosis of Pregnancy by Auscultation.

ing 140; these pulsations vary in the same fœtus as to frequency, becoming slower or faster from one time to another. The distinctness with which they are heard will of course depend upon the size and development of the fœtus, and upon its position, upon the quantity of liquor amnii, and the thickness of the uterine, and of the abdominal walls. The frequency of the pulsations is uninfluenced by the mother's circulation, but it is by her temperature, increasing as that increases.

Important movements of the fœtus, whether spontaneous or resulting from external causes, are followed by an acceleration of the pulsations, while these become slower at the height of a uterine contraction.

It has been held that there is a relation between the frequency of the pulsations and the sex of the fœtus—Frankenhauser, and others—while Cumming maintained that this frequency depended upon the weight of the child. Danzats states that if the pulsations are more than 145 a minute, the probability is in favor of the child being a female; under 135, a male, and between these numbers a prediction cannot be made. Several other observers do not confirm these statements. In this country Professor Frank C. Wilson, of Louisville, Ky., has for some years given much attention to the subject, and his conclusions are presented below:—

Louisville, Ky., July 14, 1884.

Prof. Th. Parvin.

Dear Doctor: In reply to yours of 10th inst. I would say that with a reasonable degree of accuracy the sex may be predicated from the rapidity of the fœtal heart sounds. These vary from 110 to 170 per minute, and 134 may be taken as the dividing line, above which the sex will be female, and below which the sex will be male, the certainty increasing the farther you recede from the dividing point. The following rules I have found useful in determining the sex:—

From 110 to 125 the sex will be, almost certainly, male.
" 125 to 130 " " probably, male.
" 130 to 134 " " doubtful with chances in favor of male.
" 134 to 138 " " " " " " female.
" 138 to 143 " " probably female.
" 143 to 170 " " almost certainly female.

Although failures occasionally occur, they are not numerous.

Very sincerely yours,
FRANK C. WILSON.

Certainly in view of the statements of Dr. Wilson, who is one of the most careful, competent, and conscientious observers, the subject is deserving of further investigation.

Fœtal Shock, Choc Fœtal of Pajot.—Toward the end of the first half of pregnancy if the stethoscope be applied with only moderate pressure to the abdomen, the observer has from a movement of the fœtus a double sensation of shock and of a very slight and sudden *bruit.* Pajot claims that this sign, thus addressing general and special sensibility, is more readily recognized at this time than are the *bruits* of the fœtal heart, and in many cases can be recognized before the latter.

Auscultation is the most valuable of all means in the diagnosis of pregnancy. It cannot offend the delicacy of the modest, nor arouse the suspicion of a woman claiming to be pregnant when she knows she is not, or of another who seeks to conceal her pregnancy—the sounds of the fœtal heart can "neither be simulated nor dissimulated." Only one other sign equals it in value, and that is recognition of the fœtus by vaginal, or by abdominal touch. By auscultation we learn not only the fact of pregnancy, but also that the fœtus is living.

Of course auscultation gives only negative evidence if the fœtus be dead, and in such cases palpation is of first importance in the diagnosis.

The examiner should by counting the mother's pulse guard against confounding the sounds caused by her circulation with those of the fœtus. He should auscultate in a quiet room, and if his examination gives only partially satisfactory or entirely negative results, and there be any probability of pregnancy, repeat the examination once or oftener subsequently, bewaring of a hasty affirmation, but even still more of such denial of pregnancy. Time is a most important element in this diagnosis.

CHAPTER V.

THE DIAGNOSIS OF MULTIPLE PREGNANCY—DIFFERENTIAL DIAGNOSIS OF PREGNANCY—DIAGNOSIS OF PREVIOUS PREGNANCY, OF PERIOD OF PREGNANCY, AND OF DEATH OF FŒTUS—DURATION OF PREGNANCY—DATE OF LABOR—PRECOCIOUS BIRTHS—PROLONGED PREGNANCY—MISSED LABOR.

Diagnosis of Twin Pregnancy.—In the great majority of cases this is not made until after the birth of the first child; indeed, Capuron[1] thought that certain proof could only then be had; in this, however, he was mistaken, as will be hereafter shown.

The signs of a multiple pregnancy are conveniently divided into probable and certain. Among the former are unusual enlargement of the abdomen, the size being greater than in correspondence with the period of the pregnancy; unusual form of the abdominal prominence, the uterus being developed more in its transverse than in its vertical diameter; lateral is more marked than median projection, so that in some cases, as Mauriceau stated, there is a depression directly in the median line, and "an eminence on each side of the abdomen;" fœtal movements observed at different parts of the abdomen, these movements being more frequent and stronger than usual; and finally, the disorders of pregnancy are more decided than when only one fœtus is present; there is also greater liability to premature labor.

The venous circulation is seriously interfered with by the great development of the abdomen, and hence œdema of the lower limbs and of the abdominal walls. Depaul attached some importance to an œdematous swelling, triangular in form, having its base at the pubes, and its apex pointing toward the umbilicus, as indicative of a multiple pregnancy. The certain signs of multiple pregnancy are given by touch, and by auscultation. Vaginal touch may, after labor has begun, furnish the evidence of a twin pregnancy; thus, it is possible there may be recognized, as was done by Depaul in two cases, a furrow dividing the protruding bag of waters into two parts, indicating the presence of two fœtal sacs; according to Charpentier this sign was first made known by Dugès and Madame Lachapelle. The cases are rare in which it is present. But touch, as applied to the diagnosis of multiple pregnancy, is chiefly abdominal, or abdominal palpation. In consequence of the relatively less quantity of liquor amnii, and of the fact that the uterine cavity is so largely occupied by the fœtuses, passive movements of these, or abdominal ballottement, cannot be so well effected; and, on

[1] When almost eighty years of age, and after having been a teacher of obstetrics for nearly fifty years, he one day said to Pajot: "My friend, there is but one way by which you may certainly know a twin pregnancy. If you have seen one fœtus born, and find there is another in the uterus, you may be sure there are twins."

the other hand, if the very great uterine enlargement be caused by hydramnios, the mobility of the fœtuses is greater than is normally present. Again, there is, as expressed by Pinard, a permanent tension of the uterine wall in case of multiple pregnancy. "This wall, instead of being easily depressed, is tense and resisting; it gives a sensation similar to that caused by pressing upon a rubber bag distended by air or by a liquid." Next the presence of fœtal members in different parts of the uterus may be sought, and then the two fœtal poles in the upper and two also in the lower portion of the uterus concludes the diagnosis of twin pregnancy by palpation. By this means Pinard discovered in thirty-two cases the presence of twins in the uterus. He also diagnosed triplets between the fifth and sixth month of pregnancy; he found three heads, one in the pelvic cavity, a second in the right iliac fossa, and a third above and near the median line.

It is well not to entertain too great confidence in this method of diagnosis, and therefore not to be disappointed by at least occasional failures; indeed, Depaul regarded it as only exceptionally possible, as the following passage indicates:[1] "Some practitioners in fact teach that one can distinguish through the abdominal walls two fœtuses. The necessary conditions for such a diagnosis are only very exceptionally presented, for in multiple pregnancy the uterine and abdominal walls are usually tense, and can only with pain and difficulty be depressed by the hand of the examiner. Besides, it is much less easy than is generally thought to distinguish the different regions of the fœtus through the abdominal and uterine walls, and when you wish to apply palpation to the diagnosis of presentations of the shoulder and of the pelvic extremity, you will recognize how much the hips, by their roundness and resistance, offer through the walls which separate them from the hand, resemblance to the cephalic extremity."

Kergaradec was the first to point out the possibility of recognizing a twin pregnancy by hearing the sounds of two fœtal hearts. Subsequently, however, others regarded the supposed placental *bruit* as giving this proof, for indeed, according to the original theory as to the origin of this sound, it would be heard at two different points corresponding with the situations of the two placentæ. But this view, according to which the sound referred to resulted from the circulation in the utero-placental vessels, being, as has been previously shown, an error, of course a correct diagnosis could not be founded upon it. We return, therefore, to the original suggestion of Kergaradec, and find that the "double pulsations of the fœtal heart, heard at two different points of the uterus, with a maximum of intensity and without isochronism, show the presence of two fœtuses in the uterine cavity." In making this examination care should be taken to exclude any error which would arise from confounding the sounds of the mother's heart with those of a fœtal heart. In order that the diagnosis of twins can be correctly made by auscultation, the obstetrician must hear fœtal heart-sounds most clearly at different parts of the uterus, in neither case isochronous with the mother's pulse, nor isochronous with each other. The variation in frequency between the

[1] Leçons de Clinique Obstétricale.

heart-sounds of two fœtuses may be only six or eight, or it may be fifteen or sixteen, but there is always a notable difference. It must be borne in mind that the comparative results must be, in each case, those obtained at the same examination, for the frequency of the sounds of the fœtal heart varies from one time to another. Usually the maximum of intensity of the heart-sounds of one fœtus is found higher than that of the other, nor are the two maxima upon the same side of the median line. For example, referring to Fig. 95, one maximum might be heard at *D*, and the other at *A* or at *C*. The conclusion as to multiple pregnancy should not be drawn from a single examination, lest an error may arise from change of position of the fœtus, in case of single pregnancy, or from change in the frequency of its heart-sounds. Of course an error might occur in case there were more than two fœtuses in the uterus, but the contingency of triplets even is so small that mistakes thence resulting will be very rare. In a case of triplets, H. F. Naegele, by auscultation during pregnancy, diagnosed twins; when labor occurred, and after one of the children had been born, he, by the same means, discovered that there were still two fœtuses in the uterus, and then made the diagnosis of triplets.

Even if the practitioner, after careful examination, is positive of a multiple pregnancy, it is not wise in most cases to let the woman know his discovery, for to some the fact would be a source of fear and anxiety as to the labor, and to others, of care and worry as to the double burden which would be imposed upon them after the birth of the children. Of course auscultation will be without value in the diagnosis of multiple pregnancy if one of the fœtuses be dead, but palpation might then be of use. It is better, however, especially for the young practitioner, not to depend exclusively upon either mode of examination, but rather combine them, modifying the results obtained by one with those derived from the other.

Differential Diagnosis of Pregnancy.—Certain pathological conditions may be mistaken for pregnancy, and the chief of these with the means by which error as to their character may be avoided will now be given.

First. *Affections which increase the Size of the Uterus.*

Physometra.—Gas may be formed in the uterus from decomposition of retained secretions, or of fragments of an ovum. This gas may be retained if there be acquired atresia, or it may be discharged from time to time in case there be only stenosis. When stenosis and discharges of gas occurred, Gooch called the condition flatus of the uterus. Of course there is little danger of confounding a case of either form of the disorder with pregnancy. The uterus is but slowly and slightly increased in size; if it be large enough for percussion to be made, the tympanitic sound evoked thereby points to the nature of the enlargement, and at the same time palpation and auscultation give negative results.

Hydrometra.—A collection of watery fluid may take place in the uterus when this organ has become occluded. Usually the uterus is no larger than an orange, and the increase of size is slow; it generally occurs in women who have passed the child-bearing period, though

Voisin met with it in a patient only forty years of age. Schroeder has mentioned a case of its occurrence in a woman in consequence of cervical atresia caused by the application of the actual cautery for sarcoma. In hydrometra, too, the development of the uterine tumor is slower than that which results from pregnancy, and the other usual signs of this condition are absent. Both physometra and hydrometra are rare.

Hæmatometra.—Accumulation of menstrual blood in the uterus has given rise to some most deplorable errors of diagnosis, errors that, however, can be readily avoided by a careful study of the history of the enlargement, followed by a suitable examination. Such an accumulation results from either congenital or acquired atresia of some part of the genital canal, and of course this atresia can be readily ascertained by a direct examination. The history of the enlargement is that it has lasted longer than pregnancy does, that it has taken place abruptly from time to time, increasing periodically instead of continuously; the periods of abrupt increase, as a rule attended with more or less severe suffering, usually occurred once in each month. Upon palpation the uterus is found tense and resisting, not yielding and elastic as it ordinarily is in pregnancy; no fœtal parts can be felt, and auscultation is negative.

Uterine Fibroids.—The uterus is in most cases irregular in form, and is hard and resisting, instead of elastic and yielding. Instead of menstruation being absent, as is the fact in pregnancy, it is in most cases irregular and profuse; the mammary signs of pregnancy are absent as a rule, and the umbilicus does not show the changes which occur in pregnancy. The sympathetic disturbances of the early months of gestation have not been observed, and the growth has been much slower than the physiological development of the uterus; the cervix does not present the changes characteristic of pregnancy. The uterine souffle may be present, but the sounds of the fœtal heart are absent.

Increase in Size of Abdomen without Change in Size of Uterus—Ovarian Tumors.—Among the means that may be available in distinguishing these growths from pregnancy are the presence of menstruation, and the enlargement having first been observed upon one or the other side instead of in the median line, and its development being slower than that of pregnancy. But amenorrhœa is found in quite a number of patients suffering with cystic ovarian disease either if they have become anemic, or internal hemorrhage has occurred; as to the place of origin of the enlargement, unfortunately many patients observe badly or forget readily, so that this help often fails, and while usually the enlargement of pregnancy is more rapid than that of an ovarian tumor, exceptions to the rule may occur.

The deterioration of health and the emaciation, especially noticeable in the face, will be marked if the tumor has attained great size. The fluctuation is usually distinct in cystic disease of the ovary, absent or very obscure in normal pregnancy; in hydramnios the fluctuation is quite marked, but it is especially at the upper part of the abdomen, while in ovarian dropsy the fluctuation is usually more general. The results of touch and auscultation are negative, and the usual reflex disturbances of pregnancy are generally absent. Nevertheless, there are some

cases in which a positive diagnosis should not be given at once; delay and repeated examinations may be necessary rather than risk a mistake.

Ascites.—It seems strange, nevertheless it is true, that the abdomen enlarged by ascitic effusion has been mistaken for the enlargement of pregnancy. The shape of the former is different from that of the latter, and fluctuation is always distinctly and everywhere present, whereas in pregnancy fluctuation is absent except in hydramnios, and then chiefly discovered in the upper part of the uterus. In ascites the uterus is unchanged in form, size, and position; the menstrual function may be regularly exercised, and the reflex disturbances of pregnancy are absent. The disease usually has an obvious cause in some affection of the liver, kidneys, or heart. Palpation and auscultation give negative results as to pregnancy.

Accumulation of Fat in the Abdominal Wall, or in the Omentum.—Such an increase of size is more frequently observed in women from forty to fifty years of age than at any other time of life. The abdominal wall becomes not only prominent but pendent, and the woman has, as Dr. Bailie expressed it, a double chin in the belly. In such a subject it is generally easy, if she be lying down, for the physician, placing a hand upon each side of the abdomen, to include between them the entire mass, and partially lift it up, thus determining its true character. There is entire absence of the signs of pregnancy furnished by auscultation and touch.

Pseudo-Cyesis, or False Pregnancy.—False, or nervous, pregnancy generally occurs in women who have married late in life, and who are anxious for offspring, or who wish to have proof of their still having the power of reproduction. They frequently present many of the subjective and some of the objective signs of pregnancy, the intense desire to be pregnant begetting many of the evidences of the condition. In some of these subjects abdominal enlargement may be observed; menstruation may be absent, or scanty and irregular; the breasts may increase in size and contain milk; the stomach may be irritable; and, finally, the woman is usually positive that she feels fœtal movements. The climax of the delusion of spurious pregnancy may be spurious labor. The etiology of these cases is obscure. The women are honest in their belief, they do not desire to deceive others, but they are themselves deceived. Nor can this self-deception and the phenomena of false pregnancy and labor be accounted for by the action of the imagination, for similar phenomena have been observed in some of the inferior animals.

Over-fed bitches, which admit the dog without fecundation following, are nevertheless observed to be sluggish about the time they should have whelped, and to bark as they do when their time is at hand, also to steal away the whelps from another bitch, to tend and lick them, and also to fight fiercely for them. Others have milk or colostrum, as it is called, in their teats, and are moreover subject to the diseases of those which have actually whelped. (Harvey on Conception.)

Professor Haughton reported to the Dublin Obstetrical Society (February 7, 1880) an interesting case of phantom tumor observed in an ass that had been covered by a zebra; the appearance of pregnancy deceived an expert.

In the diagnosis of pseudocyesis the physician must give little or no weight to the subjective signs of pregnancy, or he will almost certainly be misled. Let him, therefore, if the alleged pregnancy be far enough advanced to make the objective signs available, trust to them, and in the contrary case wait until they ought to be plainly present in a case of true pregnancy. Usually these patients, as has been frequently observed, do not send for the physician until they have been, as they think, pregnant for several months, and then they do not ask a diagnosis—that they have made for themselves—but for the relief of some temporary indisposition, or to attend them in their approaching labor. To undeceive such an one, proving that her hopes are false, is usually a thankless and difficult task; it ought not to be attempted without first having conclusive evidence obtained by touch and auscultation.

Pathological Conditions rendering the Diagnosis difficult.—In cases of pregnancy occurring in a woman suffering from an abdominal enlargement, the former is liable to be overlooked, the pathological condition only being recognized. In some cases it is possible to remove the cause or condition hiding the pregnancy, and then the latter may be discovered. Thus if ascites be present, after paracentesis the proofs of pregnancy may become evident. But the chief means to avoid error from these sources, are repeated examinations and waiting until the signs of pregnancy become unequivocal. Pajot, in referring to these difficulties, remarks that there is one distinct characteristic of the gravid uterus by which it may be known from ascites, fibroids, hæmatometra, ovarian cysts, etc., that is that it, in the last third of pregnancy, is the only abdominal tumor in which there is found a mobile solid body in a liquid.

Diagnosis of Previous Pregnancy.—In some cases it is important to know whether a woman is pregnant for the first time, or whether she has been pregnant before, the pregnancy not ending in abortion. In the primigravida the abdominal wall is smooth, tense, and resisting, and cannot be readily depressed; the uterus is more strictly confined to the vicinity of the median line, and especially does not incline anteriorly so much as it does in the multigravida. In the latter part of pregnancy the striæ usually found upon the skin of the abdomen, are not white or pearl-colored, but pink or purplish. The mammary glands are round, full, prominent, firm, not relaxed, flabby, and pendent. The vulvar orifice is small, closed, the posterior commissure complete, the hymen may be torn, but the carunculæ myrtiformes are absent. The vagina is comparatively small, and the rugæ are distinct, prominent, and in intimate contact by the close apposition of the anterior and posterior vaginal walls. The neck of the uterus is conical, its orifice, which is closed, presenting a uniform rim or border.

In the multigravida the skin of the abdominal wall is not smooth, but is relaxed, can be grasped in folds by the hand, and presents old white striæ, though there may also be new striæ present. "The uterus, which often gives a sensation of flaccidity, readily permits palpation through the thin and relaxed abdominal covering." The previous[1]

[1] Kleinwächter.

great stretching apart of the recti muscles, in some cases permits placing the entire hand in the intervening space. The breasts are less firm, somewhat pendent, and in many cases the skin is marked by old striæ. The vulva is more or less open, and often has a bluish aspect from varices. As a rule, the posterior commissure has been torn, and the perineum may show cicatrices and loss of substance. The labia minora project beyond the labia majora, and in the orifice of the vagina the posterior vaginal wall may be found prolapsed. The only vestiges of the hymen are the carunculæ myrtiformes. The vagina is large, its walls soft, relaxed, and forming broad folds. The vaginal portion of the cervix is cylindrical or club-shaped, and becomes soft more rapidly than in the primigravida. The os, which is open, presents an irregular border consequent upon tears in child-birth, and the distinction between the anterior and the posterior lip is well marked. In consequence[1] of the greater mobility of the fœtus, and hence the more frequent transverse position, the vaginal vault is often empty. The greater pendulousness of the abdomen causes the vaginal portion of the neck to be directed to the sacral cavity.

But, as observed by Kleinwächter, all these signs have only a relative value. The striæ upon the abdomen and the breasts, and the tears of the cervix may be wanting, the perineum be entire, and the hymen no more torn than may be seen in a woman who has had sexual intercouse without pregnancy, and yet the party may have been pregnant. The signs of a previous pregnancy are chiefly the results of mechanical force, produced by carrying and giving birth to a large fœtus. They may therefore be in part or entirely absent provided the first labor was premature, and the fœtus too small to produce any injury from distension or tears.

It should be also remembered that abdominal striæ may be observed as consequences of great abdominal distension from ascites, or from ovarian cystic disease.

"If several years elapse between two labors, the soft parts may be so nearly restored to their original condition, that it will be impossible to decide whether the person be a multipara or a primipara."

Diagnosis of the Time of the Pregnancy.—In some cases it is of importance to determine how far the pregnancy has advanced. Independently of an estimate made of this time by counting from the supposed date of conception, an approximately correct conclusion may be obtained by an objective examination. This examination gives more satisfactory results in primigravidæ than in multigravidæ, because in the former the changes caused by pregnancy are more characteristic and typical.[2] The chief means in making this diagnosis are the changes in the neck of the womb, including, in multigravidæ, the patency of the external os, and the progressive permeability of the cervical canal; the size of the uterus as learned by bimanual examination, and the distance of its fundus above the pubes as measured on the abdominal wall; the changes in the umbilicus, and the formation of the secondary mammary areola; the time when the uterine souffle and the fœtal heart-sounds become audible, and the measurement of

[1] Kleinwächter. [2] Schroeder.

the length of the fœtus. With the exception of the last, measuring the fœtal length, all these have been considered, and it would be needless repetition to reintroduce them. Ahlfeld's method of ascertaining the length of the fœtus is to put one arm of the calipers in the vagina, so that the head of the fœtus is touched, of course through the thickness of the uterine wall, while the other arm is placed at the fundus of the uterus as near as possible to the highest part of the breech, the abdominal and the uterine wall, of course, intervening. The length of the child is about twice this measurement. Knowing what its length usually is at successive months, a conclusion may be drawn from the length of the fœtus ascertained by this measurement, as to the time of the pregnancy.

The objections to Ahlfeld's method[1] are that we cannot know upon what parts of the fœtus the points of the calipers are placed, or the thickness of the soft parts lying between, or, what is still more important, the degree of curvature of the fœtal spine; hence the method may be set down as worthless.

Diagnosis of the Death of the Fœtus.—If after having distinctly recognized the pulsations of the fœtal heart and fœtal movements, the obstetrician cannot again find either, and this after repeated examinations, the death of the fœtus may be affirmed. So, too, if the womb ceases to grow, and the breasts hitherto enlarged under the impulse of pregnancy lessen in size and become soft and flabby, the probability of the death of the fœtus is great. There may also be associated with the death of the fœtus a notable change in the woman's health; she is weak and languid, appetite fails, and she has irregular chills; she may also complain of a sensation of a heavy inert mass falling from one to the other side of the abdomen according to her own change of position. Pinard states that abdominal palpation, made at least eight days after the death of the fœtus, gives very different sensations from those had in palpating a living fœtus; the dead fœtus has all its tissues softened, its characteristic form is lost, and it becomes a shapeless mass. Charpentier regards the signs of death of the fœtus obtained by palpation as more hypothetical than real, more theoretical than truly practical.

Duration of Pregnancy.—Since pregnancy does not begin immediately after coition or insemination, but with the actual union of the spermatozoid and ovule, and as an uncertain time intervenes between insemination and conception, it is impossible for us to know the actual duration of pregnancy. We know in all cases when it ends, but in no case do we know when it begins. In those rare instances where pregnancy was known to have resulted from a single coition, the date of the coition does not correspond with the beginning of pregnancy. It is probable that in any case some hours, and in many several days intervened before the combination of the male and the female element occurred; Schroeder states that the interval may be from one to fifteen days. Further, we do not know whether the ovule that is fecundated is the one liberated at the menstrual period immediately preceding the

[1] Kleinwächter.

sexual intercourse, or the one corresponding to the succeeding menstrual suppression, or one escaping from its ovisac in the menstrual interval. Hence a variation of a few or of several days in the time when pregnancy actually begins.

While denied this certainty of knowledge, general observation agrees in making the period of gestation nine calendar or ten lunar months. Harvey said: "Unquestionably the ordinary term of utero-gestation is that kept in the womb of his mother by our Saviour Christ, of men the most perfect; counting, viz., from the festival of the Annunciation, in the month of March, to the day of the blessed Nativity, which we celebrate in December. Prudent matrons, calculating after this rule, as long as they note the day of the month in which the catamenia usually appear, are rarely out of their reckoning, but after ten lunar months have elapsed, fall in labor, and reap the fruit of their womb the very day on which the catamenia would have appeared, had not impregnation taken place."[1] Dr. Matthews Duncan speaks of Harvey's opinion here quoted, as "very correct," and also states that his remarks tally with the late Dr. Tyler Smith's ingenious views upon the question.

Where pregnancy has resulted from a single coition, the average interval between insemination and labor was two hundred and seventy-five days. The average interval between the end of menstruation and labor is two hundred and seventy-eight days. Variations from these averages will be considered subsequently.

Predicting the Date of Confinement.—Tables for readily calculating the time of labor are usually found in "Physicians' Visiting Lists," and therefore it is unnecessary to insert any here. But, moreover, there are simple rules by which the calculation can be made, and therefore such tables and "periodoscopes" may well be omitted. One plan is to count the number of days between the beginning of the last menstruation and that of the one immediately preceding it, and multiply the number by ten; labor comes on at what would have been the tenth menstrual period had not pregnancy occurred. A much simpler rule given by Tarnier is this: Count nine calendar months from the cessation of the flow, and add five days. Or we may add five days to the date when the flow stopped and count back three months. Thus, a woman ceased to menstruate on the fifteenth of February, now adding five to fifteen, we have the twentieth of the month, and then counting back from the twentieth of February three months, we find that the twentieth of November is the probable day of labor.

An objection to the plan of counting the duration of the pregnancy from the duration of the menstrual cycle arises from the fact that in many women this is not a uniform period, often varying from one month to another, and it certainly is very different in different individuals. According to such plan the woman who menstruates every

[1] Professor A. R. Simpson, in referring to Harvey's statement fixing the duration of pregnancy as 275 days, remarks, "The dates are derived only from the teachers of the Roman Catholic Church, and when their true meaning is investigated, it is found that the 25th of March was held as Lady-day in Pagan Rome, in honor of Cybele, the mother of the Babylonian Messiah, long before the era of our Lord; while the 25th of December was kept among many Gentile people as the birth-day of the Son of that 'Queen of Heaven.'"

three weeks, ought to have her pregnancy end in two hundred and ten days, while another whose period may happen to be thirty-one days, would have her pregnancy protracted to three hundred and ten days.

"Quickening" has been by some regarded as so uniformly occurring at four months and a half, that the time when the pregnancy would end might be determined from the time when this was observed. But, as previously stated, this phenomenon is not so uniform in its time of manifestation as to give accurate guidance. Possibly in some cases it may serve to correct an error that has been made in regard to the time at which the last menstruation occurred, and may assist in forming a probable conclusion as to the time when labor will occur.

While it is usual to speak of predicting the day of confinement, it should be remembered that the prediction is only a probable one, and indeed that the day when labor occurs is most frequently one just before or just after this.

Precocious Births.—La Motte has given the history of a woman who was delivered of a child seven months after marriage; her husband suspected her chastity, but seven months after her convalescence she was delivered again, greatly to the relief of the husband's mind; her daughters married, and each of them was delivered at seven months. He also mentions another case in which marriage took place the day that the bride left the convent, and just seven months subsequently labor occurred; after recovery she again became pregnant, and this pregnancy also lasted only seven months. Both children lived.

One of these cases was quoted by Depaul, and he observed that while precocious births are generally admitted, the unanswerable facts proving them are very rare. The late Dr. Hodge taught that in many instances strong and healthy children are delivered before the usual time. The same belief was expressed by Spiegelberg. Nevertheless it cannot be reasonably asserted that a child born, for example, at seven months will present the development of one born at nine months.[1] The former will be feeble, its weight and length will be less than normal, and, according to Tourdes, the biparietal diameter measures the same number of centimetres as that of the months of pregnancy. Ronaldson[2] has reported a case of "early viability," the child being born six calendar months and nine days after coition.

The French law recognizes as legitimate a child born six months (180 days) after marriage; but while this is a legal viability, yet it is quite exceptional for a child born before the completion of seven months to live, and even when born then, very great care is generally necessary to preserve its life. The nearer the time of birth approaches the normal the greater the probability of the child living. While not claiming that a child born at eight months will be as vigorous and as well developed as one born at full term, it is not unreasonable to hold that in some cases the fœtus may develop somewhat more rapidly, its

[1] It is somewhat remarkable that we have comprised within a few lines in the nineteenth book of the Iliad, not only a statement of the normal period of human pregnancy, nine months, but also an example of the successful induction of labor at less than seven calendar months, and of the prolongation of pregnancy beyond nine months in another subject.

[2] Edinburgh Obstetrical Society's Transactions, vol. vi.

growth favored especially by abundant supply of nutriment, than in other cases, just as seeds may germinate more rapidly, or plants have their fruits and flowers earlier in one soil than in another; in other words, there may be precocious births, but the boundary within which this may occur, though incapable of being defined, is probably a very narrow one.

Prolonged Pregnancy.—Few questions in obstetrics have caused more controversy than as to whether the period of utero-gestation can be materially prolonged beyond two hundred and eighty days. It is still unsettled. As late as 1870, in a trial before the Court of Queen's Bench, upon the charge of seduction, very contradictory evidence as to the prolongation of the ordinary period of pregnancy was given by distinguished obstetricians. In the United States obstetric authorities have generally upheld the view that prolonged pregnancy may occur. Dewees asserted that in each of four women under his observation, pregnancy lasted ten calendar months. Bedford stated that there is undoubted evidence that pregnancy occasionally extends beyond three hundred days. Dr. Hodge gave from his own practice a case in which he regarded it as certain that pregnancy continued three hundred and two days. Warrington, apparently founding his opinion upon the evidence in the Gardner Peerage case, says that some women have been pregnant ten calendar months (311 days). Meigs, after detailing Asdrubali's case, in which pregnancy was alleged to have continued thirteen months and twenty-two days, and expressing his belief in its truth, narrated the history of a pregnant woman under his own care, whose pregnancy lasted four hundred and twenty days. American physicians have reported in medical journals a few instances of protracted gestation. Among these is that of a case where it was believed to have lasted three hundred and thirty days.[1] Dr. L. A. Rodenstein has given four cases of prolonged pregnancy;[2] he suggests as the probable limit to this increased duration, two months.

Thomson has recently reported a case in which pregnancy lasted three hundred and seventeen days from the last menstruation, or three hundred and one from the last coition.[3]

Some of the most eminent of foreign physicians have held that prolonged gestation may occur. Naegele, in his well-known work, asserts that there are undoubtedly cases where the pregnancy has lasted 300 days, and even longer. The late Dr. Churchill[4] said: "Dr. Montgomery relates two cases in his work, one of which came under my observation; in the first, the gestation continued 291 days, and in the second forty-one weeks, and two or three days at least." He adds to this statement, that the question being one chiefly of authority, positive evidence must infinitely outweigh mere negation. Spiegelberg[5] has remarked that the variations in pregnancy lie chiefly between the 265th and the 280th days; cases in which a fœtus has matured in a shorter time are rare, somewhat more frequent are those in which birth

[1] Boston Medical and Surgical Journal, May, 1859.
[2] American Journal of Obstetrics, June, 1882.
[3] London Obstetrical Society's Transactions, vol. xxvii.
[4] Theory and Practice of Midwifery.
[5] Op. cit.

took place after 280 days. Individual conditions certainly have an influence upon the pregnancy, thus primiparous and legitimate pregnancies end earlier than their opposites. He also refers to the dependence of the duration of the pregnancy upon the menstrual cycle, as pointed out by Cederschojold and Berthold, and hence variations in individuals according to their menstrual periods; there may be also variations in the same person in different pregnancies. On the other hand, Stoltz takes the position that pregnancy cannot be prolonged beyond fifteen days; Depaul, referring to the French law making a child legitimate born 300 days after the departure or death of the husband, considers the limit very large; Kleinwächter denies prolonged pregnancy; Dr. Robert Barnes holds that a pregnancy lasting 300 days is highly improbable; and Tarnier states that it is impossible to admit an intra-uterine pregnancy passing the highest limit of normal pregnancy unless some obstruction at the cervix prevents delivery.

The evidence in favor of protracted gestation which is adduced before legal courts is weakened by the fact that in such a trial not only property but reputation is at stake, so that the physician in deciding this question cannot regard such evidence as conclusive. In this country the legitimacy of birth at the 317th day has been judicially decided, an extreme limit according to most obstetricians.

If precocious births be granted, it is difficult to deny delayed births; if development be hastened in one case, it certainly may be protracted in another. But neither in rapid nor in tardy development is the difference such that more than a few days can be thus accounted for. That labor may be delayed for a few weeks, is the belief of many obstetricians from their personal observations. Thus, in illustration, it is not uncommon for a woman, in most cases a primigravida, who passes the time at which her delivery, counting from her last menstruation, was expected, and then after a delay of two, three, or even four weeks falls in labor; the labor is tedious, a large head, its ossification further advanced than is usually found at birth, is to be molded; in some cases the forceps must be used, but whether the child be delivered spontaneously or artificially, it weighs considerably more than the average, and not unseldom is still-born. Delore mentions an instance of a primigravida whose gestation lasted a month beyond the usual period; Duncan, one of a multigravida in whom the pregnancy also lasted a month overtime, the child weighed ten pounds and four ounces, and the placenta two pounds. Schroeder quotes the case reported by Rigler, as "a very conclusive one" in proof of prolonged pregnancy. A woman four weeks after the expected term, gave birth to a dead male infant, weighing ten pounds and a quarter, the hair and the nails were well developed, and the placenta weighed more than three pounds.

Cases of this kind will be admitted by most as proving the prolongation of pregnancy. Such facts, belonging so generally to personal experience, have more weight than an appeal to the uniformity of nature's laws. The argument drawn from occasional instances of prolonged pregnancy in some of the inferior animals, also has weight in sustaining the view that this is not impossible in the human female.

For example, the average duration of pregnancy in the cow is 282 days, but the time may be prolonged to 321 days.

While, with Tourdes, we may fix the physiological duration of human pregnancy at 274 or 275 days, making the minimum 200 days, and the maximum 290, it is impossible for us to say that one or the other limit may not be in exceptional cases slightly changed.

Reese, in his excellent manual,[1] takes the ground that it is possible for human pregnancy to be prolonged beyond the usually-admitted normal period, but that the question how far beyond is more difficult to answer, though the greater the amount of the deviation, the stronger and more convincing should be the proofs. He further endorses the statement of Taylor to the effect that we must "be prepared to admit either that conception may in some cases be delayed for so long a period as five to seven weeks after intercourse, or that there may be a difference of from five to seven weeks in the duration of pregnancy."

In regard to the question of a perfectly matured child being born prior to the normal period of pregnancy, he criticizes the evidence given by the late Sir James Simpson in an English case, in which the legitimacy of a child was made to depend upon the period of the mother's gestation, 259 days, Sir James testifying that it was impossible for a child perfectly matured to be born three weeks before the usual term.

I am indebted to James P. Baker, Esq., of Indianapolis, for the following presentation from a legal standpoint of the duration of pregnancy:—

The period of gestation is frequently a matter of judicial inquiry, particularly in bastardy proceedings, and in controversies among heirs, affecting legitimacy. Lord Coke, who was one of the great masters of the common law, in his work upon Littleton, written nearly three hundred years ago, held that nine months, or forty weeks, is the longest time allowed. Mr. Hargrave, in his edition of Coke upon Littleton, at page 123 b, carefully reviewed the law, and came to a different conclusion. In summing up, he said:—

"The precedents, therefore, so far from corroborating Lord Coke's limitation of the *ultimum tempus pariendi*, do, upon the whole, rather tend to show that it hath been the practice in our courts to consider forty weeks merely as the more *usual* time, and consequently not to decline exercising a discretion of allowing a longer space where the opinion of physicians, or the circumstances of the case have so required. In the course of our inquiries into the subject of this note we were curious to know the general sentiment of that eminent anatomist, Dr. Hunter, on three interesting questions. These were, What is the *usual* period of a woman's going with child? What is the *earliest* time for a child's being born alive? and What is the *latest?*"

Dr. Hunter's answer was as follows:—

"1. The *usual* period is nine calendar months; but there is very commonly a difference of one, two, or three weeks. 2. A child may be born alive at any time from three months; but we see none born with powers of coming to manhood, or of being reared, before seven calendar months,

[1] Text-book of Medical Jurisprudence and Toxicology.

or near that time. At six months it cannot be. I have known a woman bear a living child, in a perfectly natural way, fourteen days later than nine calendar months, and I believe two women to have borne children alive in a natural way, above ten calendar months from the hour of conception."

Mr. Hargrave's note has been frequently quoted by the courts up to the present time, and is still regarded as a sound exposition of the law. The question may arise, Which Dr. Hunter gave the above reply? Hargrave lived in London, and wrote the preface to his edition of Coke in January, 1785. Dr. William Hunter died in 1783. Dr. John Hunter, his brother, died in 1793. The note was probably written near the time of the completion of Mr. Hargrave's work. It is probable, therefore, from these facts, though not certain, that John Hunter was the author of the reply. But a certainty seems to be established by Mr. Hargrave referring to Dr. Hunter as "that eminent anatomist," a designation which applied more especially to John than to William Hunter, for the latter was more celebrated as an obstetrician.

Judges, like doctors, are liable to differ, and the decisions of courts have not been entirely harmonious as to the period of gestation. In the case of O'Brian *v.* The State *ex rel.* Swift, 14th Ind. 469, the Supreme Court of Indiana say:—

"Those who have investigated the subject, know that in the course of nature, a child living and capable of surviving to the ordinary age of man, may be born in seven, and may not be born until the expiration of ten months from the cessation of the *catamenia* indicating the time of its conception."

The case of Duck *v.* The State *ex rel.* Dill, 17th Ind. 210, was a prosecution for bastardy. In such a case, the question always is, "Is the defendant the father of the child?" Any evidence tending to show that any other man is the father is admissible. The child was born on September the 18th, 1858. On the trial the defendant offered to prove that the relatrix had had sexual intercourse with another person in the first week of November, 1857. The evidence was rejected. The Supreme Court held that this evidence was rightly rejected, and said:—

"It is true, experience proves that the period of gestation is almost as variable in individual cases, though within narrow limits, as that of the length of human life, but the longest period we have ever known to be judicially allowed was 313 days. See the case of Commonwealth *v.* Hoover, 3d Clark, Pa. 514. In the case at bar the evidence might have covered a period of 322 days."

A still longer time was judicially allowed, however, in the case of the United States *v.* Collins, tried in the U. S. District Court for the District of Columbia in 1809, and reported in Cranch's Circuit Court Reports, vol. 1, page 592. The case was an indictment for not supporting a bastard child. The mother was received as a witness. The attorney for the government objected to the cross-examination as to her connection with other men than the defendant. The Court overruled the objection, but limited the time of inquiry to a period of not more than twelve months nor less than six months before the birth of the child. This is an extreme case. In Paul *v.* Padleford, 16 Gray (Mass.), 263, a bastardy prosecution, the Court refused to allow proof of acts of intercourse of the plaintiff with other persons than the defendant, at a time more than ten months and twelve days before the birth of the child. In Phillips *v.* Allen, 22 Allen (Mass.), 453, the Court said:—

"The child was born in eight months after the marriage, and the fact that a child is born thus soon after the husband had first access to the wife does not prove beyond all reasonable doubt that the child is not his. There are ancient decisions that gestation somewhat more than nine months after the husband could have had access to the wife, does not disprove the legitimacy of the child. See Hargrave's note to Coke's Litt. 123 b, where these decisions are cited, and where in support of them the testimony of Dr. Hunter is introduced, expressing his opinion that gestation often varies from one to three weeks from nine calendar months, and that children are sometimes born in seven months from conception, and live and grow to manhood."

In Eddy *v.* Gray, 4 Allen (Mass.), 427, which was a bastardy prosecution, the Court below had admitted testimony tending to show illicit intercourse by the complainant with other men than the defendant at a period of time more than ten months before the birth of the child. The Court said:—

"Such testimony, in the absence of proof that the period of gestation extended beyond the usual duration according to the common and natural course of life, which is recognized as well by legal as medical authorities, is inadmissible, and should have been excluded. See Co. Litt. 123 b, and note by Hargrave."

In the recent case of Ronan *v.* Dugan, 126 Mass. p. 176, a prosecution in bastardy, the Supreme Court of Massachusetts say:—

"In cases of this kind, the admissibility of evidence of illicit intercourse of the complainant with any other man than the defendant, depends upon the relation to the time when the child was born. In Eddy *v.* Gray, 4 Allen, p. 435, where the intercourse offered to be proved occurred more than ten months before the birth the evidence was held to be inadmissible, without proof that the period of gestation was prolonged beyond the usual duration. We see no reason why the same rule should not be followed where the intercourse offered to be proved took place less than seven months before the birth, in the absence of the proof that the birth was premature."

In such a case the Tennessee Code limits the inquiry between the first of the tenth and the first of the sixth month next before the birth of the child. See Crawford *v.* The State, 7 Baxter, 41.

Wharton, in his work on Evidence, at section 334, says:—

"The court will take judicial notice of the ordinary periods of gestation, so as to assume the non-legitimacy of children born ten months after intercourse, or when prior non-intercourse is proved five months after the act of intercourse."

At section 1300 he says:—

"The time of conception is determined by the Roman practice by reckoning backwards from the time of birth; and the rule is that there must be not less than one hundred and eighty-two days and not more than ten months to establish legitimacy. German jurists have continued to maintain the minimum of one hundred and eighty-two days. In our own practice the question of legitimacy, when a child is born on either side of the usual limits of parturition, is determined on the testimony of experts; though in cases beyond question, the court may determine what is notorious as a part of the ordinary laws of nature."

After all, the light of the courts in this matter, is reflected light. Physicians must determine the matter; and if the space between the minimum

and maximum periods, hitherto allowed, is shown to be too long or too short, the courts will readily follow the truth as it is made manifest.

Missed Labor.—This term, introduced by Dr. Oldham, is applied to those cases in which a dead fœtus is retained in the uterus for weeks, or even months, beyond the period when pregnancy ordinarily ends. In these cases nature makes an effort at the normal time to expel the contents of its cavity, but the effort fails, and the pregnancy continues an indefinite period until those efforts are renewed successfully, or the contents are removed by artificial means.

CHAPTER VI.

THE MANAGEMENT OF PREGNANCY.

WOMAN only escapes being sick twelve times a year by having an illness which lasts nine months, was the assertion of a once famous French *litterateur*. Previous to this a celebrated French obstetrician said that pregnancy was a nine months' disease. Though, of course, rejecting these statements and denying that gestation is a disease, we must admit that it has many discomforts, and in numerous instances causes great liability to pathological conditions, and in some these conditions are manifested. The remarkable changes that occur in the organism or in the organs of a pregnant woman may open the way for maladies which are manifested during or subsequent to the pregnancy. It is advisable therefore that all care, and even precautions, be taken to ward off threatened dangers, and to conduct the subject safely through her pregnancy, both in her own interest and in that of her offspring.[1]

The conduct of pregnancy includes hygienic and medical care.

Hygiene of Pregnancy.—This relates to food, clothing, air, exercise, rest, sleep, bathing, care of the breasts, and to the mental condition.

Food.—In many cases during the first months of pregnancy the disturbance of the stomach, and the less active life often consequent upon this disturbance, and in some the associated mental anxiety, lessen the desire for food. Nevertheless it is better that an effort at least be made to observe regular meals, although the quantity of food taken may not be as much as usual.

In some cases the morning sickness may be lessened, if not averted, by the patient having a light breakfast an hour or two before rising.[2]

[1] That special care of the pregnant woman was in early times regarded as important, is shown by the practices of many ancient people, and by the injunctions of old medical writers. The following, for example, are the directions given by Susru-fa, the earliest known medical writer of India, who lived at least fourteen hundred years before the Christian era. Many of these directions are wise, while the reason for others cannot be understood:—

"The pregnant woman should avoid becoming weary, indulging in coition, sleeping in the daytime, watching at night, sorrow, climbing into a wagon, sitting upright, violent movements, phlebotomy, and long-continued exertion. Her longings must be satisfied in order that she may have a strong and long-lived child. From the first day she must be cheerful, pious, and clean in clothing and person. She should not touch dirty or deformed objects, nor eat any dry or spoiled food. She must not go out, or remain in an empty house, or go to the holy altar, or in graveyards, or near trees; she must avoid getting angry, carrying loads, or talking too loud."

[2] The late Professor Meigs stated: "Many of those examples that consist of nausea and vomiting during the early part of the day, but which cease after the meridian hour, may be set aside by the following method: Let a cup of coffee, with a toast, be brought to the bedside at the earliest morning hour. The patient should be called from her sleep to take this preliminary breakfast without rising from bed. As soon as it is taken let her lie down to

When this disorder disappears the appetite usually returns, and in some is greater than it was before pregnancy. The food should be both animal and vegetable, and especially include digestible fruits in their season; the last will aid in preventing the constipation which so generally attends the pregnant condition.

It occasionally happens that a woman when pregnant desires articles of food to which at other times she is indifferent; and these desires ought not to be refused, for they may express some need in her system for certain materials which are thus supplied; they are very different from the perversions of appetite which by some are imagined or assumed.

It is important that the stomach should not be overloaded at any time, especially in the evening. When the uterus encroaches most upon the stomach in the latter part of pregnancy, it is generally the case that only a small quantity of food can be taken at a time, and then the meals may be more frequent than usual.

Alcoholic liquors ought not to be used, but the drink should be milk, water, or chocolate; those who are accustomed to coffee and tea will doubtless continue them, but these beverages should not be strong, and they should not be taken in large quantities.

Clothing.—This should be such as will not hinder the development of the abdomen and the breasts, and at the same time will protect from cold. The word *enceinte*, meaning in Latin ungirdled or without girdle, commemorates the custom of Roman women, who, when they became pregnant, laid aside their girdle, the *fascia mamillaris*, and it suggests avoiding all compression of the body. Baudelocque mentions the case of a girl who sought to conceal her pregnancy by tight lacing, and thus brought on a dangerous hemorrhage. The corsets should be quite loose; the garters, if tight, may cause œdema of the legs, or varicose veins. Insufficient or unseasonable clothing may lead to an acute affection of the respiratory organs attended with violent coughing, and the latter cause abortion; or sudden suppression of the perspiration occur from exposure to cold and result in albuminous nephritis. The high-heeled shoes so commonly worn by ladies tend to increase the forward inclination of the body, and thus render more difficult the position which a pregnant woman must take to preserve the centre of gravity when standing or walking; they make her more liable to missteps, and thus danger of falling, thereby injuring herself or the fœtus, and of jars that may cause partial detachment of the ovum. If, as is often the case in the multigravidæ, the abdominal wall be greatly relaxed permitting decided anteversion of the uterus, a suitable bandage contributes very much to the patient's comfort, and by restoring the form of the womb assists in preventing an unfavorable presentation of the fœtus.

Air.—Pure air is of especial importance for the pregnant woman,

sleep again, if possible It appears useless to offer a rationale of this method. I am very confident, however, that, in a considerable number of persons, it will be found to put a sudden stop to the vomiting as well as to the nausea. Certainly many of my patients have been speedily, as well as permanently, cured by it, and that in very distressing instances of the nausea."

for she breathes for two, and is eliminating an increased quantity of carbonic acid. A confined atmosphere has an injurious influence both upon her and upon the fœtus, and exposure to carbonic acid may cause abortion. She should avoid all crowded halls, whether theatres, concert, or ball-rooms, or churches; all poisons in the air such as that of sewer gas or of infectious diseases should be carefully guarded against; the room occupied in the day or in the night must be well ventilated; if possible, a part of each day ought to be spent in the open air.

Exercise, Rest, Sleep.—If a woman in the first months of pregnancy suffers much from nausea and vomiting, she is little disposed to exercise; she is weak from the less amount of food taken or retained, and any movement may increase the gastric irritability. Again, toward the close of pregnancy her great size interferes with ready movement; both her condition and instinct ask for repose more than for active exertion; if we observe the conduct of pregnant animals we find that as parturition draws near they are indisposed to exertion, and spend much of their time lying down. But in woman during the intervening time daily exercise in the open air, carried to the point of slight fatigue, is one of the best means to increase her vitality and that of her offspring; her appetite is thus improved, her digestion made stronger, and refreshing sleep secured. The best exercise is given by walking, and without some special reason against it, that should be chosen rather than riding. All violent exercise, such as riding over rough roads, dancing, or lifting heavy weights, must be forbidden; so, too, prolonged exercise, causing great fatigue, and protracted journeys by land or sea, are to be avoided. Regular hours of rest are to be observed; from eight to ten of the twenty-four should be given to sleep. In women liable to abortion absolute rest is often necessary, especially at the time corresponding with a monthly period, to guard them against the danger; in some rare cases, rest in bed during almost the entire pregnancy has been required in order to avert this accident.

While making these observations as to the importance of general rest, it is well to refer also to physiological rest, or rest for the sexual organs in pregnancy. Obstetric writers agree in forbidding sexual intercourse when there is a liability to abortion, in advising it to be less frequent in other cases, and abstained from at times corresponding with monthly periods, especially the third and seventh, in one the danger of abortion, in the other that of premature labor being greatest. Among recent writers, Kleinwächter remarks that coition is to be restricted the first half of pregnancy, and unconditionally forbidden the second half. In a recent work[1] by Dr. Benjamin Ward Richardson, the direction is given that the bed of a pregnant woman should be occupied by herself exclusively. Dr. Richard[2] says that if the human race were guided by the example of animals, and if it perfectly conformed to the advice of nature which most frequently inspires the pregnant woman with complete indifference and even some aversion to marital caresses, coition during gestation would be entirely abandoned.

[1] Preventive Medicine.

[2] Histoire de la Génération.

Other writers have referred to the aversion which Richard mentions. Thus Roederer[1] enumerated among the signs of pregnancy *viri fastidium*. It is remarkable that among the signs of pregnancy given by Susru-fa, the dread of coition is mentioned. Stoltz[2] states that women have told him that as soon as they were *enceintes* they had *horreur du mari*, some of them by this sign first knowing that they were pregnant.

If the relation between husband and wife had no higher purpose than perpetuating the race, it is plain that sexual intercourse should cease when the vow of nature is being fulfilled; such indulgence may cause abortion, and has been compared to ploughing the soil when the seed is germinating; in many cases it is painful, excites or aggravates leucorrhœa, and may cause more or less reflex disorder. There is a moral side to this question. Many a wife must have less love and reverence for her husband when she, sick and suffering, or at least often wearied by the growing burden she bears, her mind a prey to anxious fears as to the issue of her pregnancy, is the victim of lust,[3] a lust which has no excuse in her desires, no demand for the continuance of the race. Man does not learn that self-restraint which makes him purer and nobler, but nourishes a passion that becomes more dangerous by such exercise than it could by any voluntary continence during his wife's pregnancy. Admitting that the state of society changes the instincts of nature, and that the indulgence condemned, in many cases, brings no immediate and obvious injurious physical results, it may well be questioned whether most obstetric writers have not, either tacitly or explicitly, granted a license which leads to more evil than good.

Bathing.—The frequency and temperature of baths will depend upon a patient's previous habits; but usually once or twice a week is as often as a bath, cold or warm, is advisable: hot baths,[4] whether of the feet or of the entire person, must be forbidden. The external genital organs should be bathed daily with cool water as a protection from erythema, and to cleanse from increased secretion which retained might cause irritation; if leucorrhœa be troublesome there is no objection to tepid vaginal injections of water, plain or medicated, *e. g.*, with common salt, chlorate of potassium, or borax; the fluid should be injected gently, used as a wash, not as a douche.

Dr. G. W. Lawrence, a distinguished practitioner residing at Hot

[1] Op. cit.

[2] Op. cit.

[3] In Swift's terrible satire upon human beings, given in Gulliver's Voyage to the Houyhnhnms, it is stated that "the she-yahoo admits the male while she is pregnant," and this is spoken of "as such a degree of infamous brutality as no other sensitive creature arrives at."

For the following statements I am indebted to Ploss's work, *Das Weib*:—

In the majority of heathen nations sexual continence is observed during pregnancy. Among many the abstinence from coition has arisen from the belief that the pregnant woman is unclean. By the Medes and Persians cohabitation with a pregnant woman was severely punished. Among some people polygamy is based upon abstinence from coition in pregnancy.

The old Hebrews and the Rabbis in the Talmud taught that coition during the first three months of pregnancy was very injurious to both the mother and child. Whoever cohabited on the ninetieth day did that which destroys human life, but the prudent Rabbi Abaja adds, "Since we cannot know this day with certainty, God preserves the simple from injury."

The ancient Irans very severely punished cohabitation with the pregnant woman. The man received 2000 lashes, and was compelled to carry 1000 loads of heavy and 1000 of light wood to the fire. He must offer in sacrifice 1000 of the smaller domestic animals, and kill 1000 snakes, 1000 land lizards, 2000 water lizards, and 3000 ants, and lay 30 bridges over flowing water.

[4] Warm hip-baths during the last week of pregnancy are by some thought useful in facilitating labor.

Springs, Arkansas, informs me that abortions have frequently been caused by the use of hot baths at this famous health resort. But other physicians residing there have not observed this fact. Tardieu,[1] after referring to the universal use of baths under all forms by those practising abortion, observes that he does not know a single instance authorizing him to believe that abortion was its direct consequence.

Care of the Breasts.—It has been previously stated that the clothing should be such that no compression of these organs, especially of the nipples, is permitted. If the nipple be small the woman should be taught to use her thumb and finger to draw it out, giving it suitable form and size; this process begun some months before labor, and exercised for a few minutes each day, will often give very favorable results. It is in the highest degree improbable that the action of the uterus could be thus excited, causing abortion or premature labor. In rare cases it may be advisable to use at first, but very gently, atmospheric pressure by means of a breast-pump, and also to wear a solid nipple-shield which protects the organ from pressure, and gives room for its development. Keeping the nipple too constantly, too warmly covered, renders the skin more delicate and sensitive, and therefore is to be avoided, while daily exposure to the air has, according to Delore, the beneficial effect of rendering the epidermic secretion more active. Cleanliness is important, for the secretions from the nipple and that from the gland, which occur during pregnancy in many cases, and allowed to collect, render the skin beneath very liable to become excoriated when nursing begins; the nipples, therefore, are to be washed each day, generally with simple water, occasionally soap may be added. Bathing the nipples daily with alcoholic and astringent solutions is a common practice in pregnancy, it being believed that thereby excoriations and fissures of the nipples are prevented. But it is doubtful whether the theory is wise, or the practice justified by results. Such applications effectually remove the secretion and probably lessen the activity of the sebaceous glands—thereby in some degree doing away with the protection nature gives to surfaces exposed to contact with liquids; these solutions make the skin hard and stiff which nature meant to be soft and pliable. It would be better to use simply tincture of arnica, or bay rum, one part to three of water, if an alcoholic preparation is advisable; but in any case there should be applied to the nipple at night a small quantity of cocoa butter. Certainly the prophylaxis of acute disease of the nipple in nursing women, which so often leads to mammary inflammation, is better, more rationnally sought by the simple means just mentioned, than by those in common use.

Condition of the Mind.—Not only the pregnant woman's own health but that of her child is in some degree dependent directly or indirectly upon her mental state. Her sensibility is increased, and therefore she should be carefully guarded against injurious impressions; she should be saved all needless pain, all possible petty irritations, all sudden fright or shock. The exercise of a cheerful temper should be advised,

[1] Étude Médico-Légale sur l'Avortement.

as well as occupation of the mind in some useful work, in reading or study, and the society of cheerful friends, with occasional pleasant recreation.

Quatrefages said that it has been long since remarked children begotten in a fit of intoxication often present forever after the characteristic signs of that state; obtuse senses and the almost entire absence of the intellectual faculties. When the temporary state of the progenitor has such a powerful influence upon the germ it is not probable that the evolution of that germ is unaffected by the mental states of the mother. The belief that the unborn child may be affected through the mother's mind has that criterion which one of the great philosophers of the day regards as indicating some measure of truth, it is universal and perennial. Moreover it has the indorsement of high professional authorities. Stoltz[1] remarks it is incontestible that a vital communication exists between the mother and the fœtus as long as the latter is contained within her, and vivid impressions experienced by the former can be transmitted to the latter, and become injurious to it.

The pages of Esquirol[2] present illustrations of the statement just made. According to Sir Walter Scott, the startling effect which a drawn sword had upon James I. "seemed so be as constitutional as his timidity, and was usually ascribed to the brutal murder of Rizzio having been perpetrated in his unfortunate mother's presence before he yet saw the light." The evidence adduced by Saint-Hilaire is more convincing; he has proved that unmarried women forced to conceal their pregnancy are more liable than others to produce monsters.

The late Dr. Montgomery held that it was quite consistent with reason and the present state of our knowledge to believe that a very powerful impression on the mother's mind or nervous system may injuriously affect the fœtus. Dr. Meadows[3] has said : "I do not hesitate to avow my conviction, formed after no little thought upon the matter, that the mind of the mother can and does sometimes so interfere with the ordinary processes of nutrition and growth in the fœtus, as variously to check or modify its development in whole or in part, and thus to produce deformities or monstrosities."

A belief which has been avowed by such men as Rokitansky,[4] Stoltz, Montgomery, Meadows, Tyler Smith, and others of equal ability and fame, cannot be set aside as simply resting on old wives' fables. Nor is it to be set aside for the reason that we do not know how the causes and effects are connected, a mystery of mode which we do not, possibly never will, comprehend.[5] Conception itself presents mysteries[6]

1 Op. cit. 2 Treatise on Insanity.

3 Transactions of London Obstetrical Society, vol. vii.

4 Pathological Anatomy.

5 "The singular influence thus exerted by the mind of the mother on the growth of the fœtus, is not one 'for which,' as has been remarked of other modes of action of the mind upon the body, 'it is likely we shall ever be able to assign a reason, or which it would be any great hardship to be obliged to regard as an ultimate fact in physiology.'" Dr. Alexander Harvey, *On the Fœtus in the Uterus.*

6 "Is it not marvellous," says Montaigne, "that this drop of seed from which we are produced should bear the impression not only of the bodily form, but even of the thoughts and inclinations of our fathers? Where does this drop of water keep this infinite number of forms? and how does it bear these likenesses through a progress so hap-hazard and so irregu-

the solution of which will probably always elude the research of man, so that we may continue with Harvey to admire and marvel at this process.[1] But in recognizing the fact that the fœtus may be affected through the mother's mind, we must beware of accepting most of the popular evidence given in its favor; for example, a child is born with a deformity which the mother attributes to her having seen a similar deformity while she was pregnant, but upon inquiry it is ascertained that she saw it after the stage of embryonic development in her own child had passed when its deformity resulted. Very many of the stories of the influence of maternal impressions are absurd, carrying with them their own contradiction, and are often suggested, or even fabricated after the birth of the child.

In addition to the probable but occasional coarser proofs of the influence of maternal mental impressions upon the unborn child, as shown in monstrosities and in deformities, it is possible, nay probable, that very important effects are produced by the condition of the mother's mind in pregnancy which belong to the psychical[2] rather than to the physical nature, effects that are gradually made manifest in childhood, in youth, and in adult life. It not unfrequently happens that children of the same mother differ very greatly in mental and in moral qualities, they differ in the power of acquiring knowledge, in objects of desire and pursuit, in aptitudes and accomplishments. In some instances it is possible to trace a probable connection between these differences, and, not only the condition of the mother's health during the several gestations and the surrounding circumstances, but also with the state of her mind during those periods. Here is opened a wide field not merely for speculation but for actual investigation. And the more the whole subject of human reproduction is studied with regard to the physical and mental health, and the happiness and usefulness of the offspring, the more grave and solemn the responsibility of paternity and of maternity will be proved. Enough is known, and enough has been said, to urge the importance of the pregnant woman living as far as possible a calm, equable, and cheerful life, avoiding all intense emotion and all great excitement.[3]

The Medical Care.—Under this head it is proposed to briefly consider some of the most frequent, but usually minor, disorders of pregnancy and their treatment.

lar that the great-grandson shall resemble the great-grandfather?" Had Montaigne lived after the important discovery made by Ham, he would have substituted spermatozoid for "drop of seed," and declared the marvel vastly greater.

[1] Bain has said: "The reproduction of each living being from one or two others through the medium of a small globule which contains in itself the future of a definite species, is the greatest marvel in the whole of the physical world; it is the acme of organic complication."

[2] In a paper by Dr. Robert J. Lee, entitled "Maternal Impressions," published in the *British Medical Journal*, 1875, the following remark is made: "It would, on reflection, appear to be most natural that maternal impression should be more frequently followed by some unnatural condition of the intellect of the child than by abnormalities of growth, and this point is worthy of particular attention."

[3] Plato, in the Seventh Book of Laws, after speaking of the susceptibility of the newly-born infant to impressions, remarks: "Nay, more, if I were not afraid of appearing to be ridiculous, I would say that a woman during her year of pregnancy should of all women be most carefully tended, and kept from violent or excessive pleasures and pains; and at that time she should cultivate gentleness, and benevolence, and kindness."

Nausea and Vomiting.—The gastric irritability so generally marking the early months of pregnancy is reflex. It is probably caused, in most cases, by the unaccustomed stretching of the uterine tissues, and ceases as those tissues become more relaxed and yielding. Diseased conditions of the cervix or displacement of the uterus may also be causes. The affection is usually more severe in the primigravida than in the multigravida, because in the former the uterine fibre yields less readily. If hygienic means fail, such as taking the morning meal in bed, iced drinks, lime-water and milk, etc., a change of scene—especially if it secure the patient against the possibility of coition—and medical measures may be required. Among these no one probably is more useful than tincture of nux vomica, given in doses of two to five drops three or four times a day, or oftener if necessary, especially when the smaller quantity is used. The oxalate of cerium was highly recommended by the late Sir James Simpson; it may be given in five or ten-grain doses. The tincture of aconite root, two drops three or four times a day, was very favorably regarded by both Dr. Meigs and Dr. Hodge. Chloral in solution, either with or without bromide of potassium, may be injected into the rectum; the dose is twenty grains. Water as hot as it can be taken, and given in teaspoonful doses—as advised by Mr. Keith for the relief of ether-vomiting after ovariotomy—will in some cases prove useful. Morphia, used either by the hypodermatic or the endermic method, is valuable; so, too, counter-irritation at the epigastrium. Among the great number of other means that have been recommended are water impregnated with carbonic acid, iced champagne, creasote, hydrocyanic acid, bismuth, Fowler's solution, wine of ipecacuanha, belladonna, an ice bag applied to the spine, ice or ether-spray to the epigastrium, inhalation of oxygen, and the electric continuous current. The very multiplicity of the means advised is a strong testimony to the uncertainty of the results obtained in the treatment of this disorder.

In all cases obvious derangement of the secretions should be corrected, and constipation should be relieved. A strong desire for particular food or drink may be usually gratified; one patient who rejected all food apparently the most appropriate, and could not retain even ice-water, lived for some days upon lager beer.

The local treatment of the affection includes the application of belladonna to the neck of the womb (Cazeaux), nitrate of silver to the cervix when congested or inflamed (Bennet), correction of uterine displacements (Hewitt), leeching the cervix (Clay), digital dilatation of the cervical canal (Copeman). Without adopting Graily Hewitt's theory of the etiology of the disorder, it is certain that in some instances the patients are cured by rectifying a mal-position of the uterus. In rare cases it is advisable to give the stomach a few days' rest, nourishing the patient exclusively by rectal injections.

Salivation.—This is a less frequent disorder than the preceding, but the two may be connected, and usually are when either is severe. Washing the mouth out frequently with a cold astringent solution is in most cases the only treatment required. A sudden suppression of the excessive secretion may be followed by serious consequences;

Baudelocque refers to a young woman who in her first pregnancy suffered greatly from salivation, but was refused any means for its relief; in her second pregnancy the same symptom recurred, and means were successfully used to arrest it, but the day following she died of apoplexy.

Constipation.—If this cannot be prevented by suitable diet, an injection of a pint of cool water may be used each morning. If medicines must be resorted to they should be mild laxatives, such as calcined magnesia, Seidlitz powder, Rochelle salts, the liquid citrate of magnesia; a few prunes that have been stewed in an infusion of senna, eaten in the evening, will in some cases prove an efficient means of removing the constipation; so too one of the mild aperient waters, such as Hunyadi, may be used. All drastic purgatives should be avoided. If the constipation be associated with hemorrhoids Dr. Fordyce Barker[1] advises a grain of aloes made into a pill with soap, hyoscyamus, and ipecacuanha and given night and morning. Cazin[2] commends in this condition a pill containing one or two centigrams of belladonna given daily, as advised by Bretonneau.

Hemorrhoids.—In addition to the removal of constipation by the means just mentioned, half a pint of cold water should be injected into the rectum morning and evening, the injection being retained. When the piles protrude and are painful, they may be bathed with warm water and laudanum, or one part of tincture of arnica and four of water, or the ointment of galls and opium may be applied: the protrusion should be reduced as soon as possible.

Œdema of the Legs—Varices.—The former is in many cases a consequence of the latter. It usually disappears after lying down for a time, and is to be treated by position, by removing all constriction, as from garters, and by bathing with cool water. Varices, according to Budin, occur in twenty to thirty per cent. of pregnant women; but in many cases the dilatation of veins must be very slight if there be so large a percentage; my own observation leads me to believe that only from five to ten per cent. of women are thus affected in pregnancy. Those situated in the lower limbs are treated by position and compression. Cazin[3] advises the application first of an old linen bandage, and over this one of flannel extending from the toes to a point above the enlarged vessels. Some prefer an elastic stocking, but a flannel bandage is less expensive, and, properly applied, more comfortable. It is to be remembered that too great compression has caused abortion. An accident to which the patient is liable, either from violent scratching, from a blow, or sometimes simply from the pressure of the column of blood in unsupported vessels, is a rupture of one of them permitting a hemorrhage rapidly fatal if the flow be not promptly arrested. The patient should be informed of this danger of rupture, and told to at once stop the flow by firmly pressing her finger upon the bleeding point.

Pruritus of the Vulva.—Itching of the vulva is a symptom of various conditions, such as œdema, follicular inflammation, eczema, herpes,

[1] Puerperal Diseases. [2] Archives de Tocologie, 1881. [3] Op. cit.

or prurigo, etc. It is not remarkable that the external generative organs, sharing in the increased supply of blood occurring in pregnancy, and in some cases the seat of passive congestion caused by the enlarged uterus, should be liable to some of the local affections mentioned, and which have as their most prominent symptom a more or less intense itching. The violent rubbing and scratching which the pruritus cause in some cases, of course aggravates the disease. The irritation sometimes extends to the vagina, but it usually occupies only the great and less lips. The vulvar inflammation from which the pruritus results may be caused by a vaginal discharge.

The suffering of some pregnant women from this cause is often very great. Dewees has spoken of a woman under his charge, thus afflicted, who was confined to her room during three months of her gestation, and whose only relief in her entire period was had by the nearly constant application of ice-water.

He also described an aphthous eruption as present in some cases, and for this he advised a strong solution of borax; it may be used for bathing the vulva, and also for injecting in the vagina, and frequently proves quite beneficial.

Some patients find relief for the itching by applying to the vulva cloths wrung out of hot water.

Dr. Tauszky recommends the application with a brush to the affected parts eight or ten times a day of the following solution, first suggested by Hufeland: Two drachms of powdered gum Arabic, one of balsam of Peru, one and a half of oil of almonds, and one ounce of rose-water. A very weak solution of corrosive sublimate, ointment of oxide of zinc, powdered starch mixed with camphor, or oxide of zinc, or salicylic acid, and an ointment containing iodoform or chloroform have been recommended. De Sinéty[1] advises the following liniment and wash:—

℞.—Chloroform	3	grams,	or	46	grains.
Oil of sweet almonds,	20	"	"	300	"
Oil of cade	20	"	"	300	"
Laudanum	1	"	"	15	"
S.—To be well shaken.					

℞.—Crystallized carbolic acid,	1	gram,	or	15	grains.
Thymic acid	2	grams,	"	30	"
Alcohol	10	"	"	f℥ijss	
Water	200	"	"	f℥viss	

In some cases it is necessary to give one of the alkaline bromides and chloral at night.

Neuralgia.—The various neuralgic affections, which are not uncommon accidents of pregnancy, frequently prove at this time peculiarly obstinate. The bromide of quinina, or quinina in combination with the aqueous extract of opium and the extract of belladonna, will often be useful whether the neuralgia be malarial or dependent upon some other cause. Morphia, administered hypodermatically, and croton-chloral are among the most efficient means for relieving pain.

[1] Maladies des Femmes.

Among local applications chloroform liniment, tincture of aconite root, and a mixture of equal quantities of camphor and chloral, may be mentioned. Painful affections of the teeth are to receive the same treatment as in the non-pregnant condition; it should be remembered that in many cases these are purely neuralgic depending upon the pregnancy, disappearing at its end if not before, and therefore the extraction of a sound tooth or one that is decayed, but which can be saved by the dentist's art, is not required.

Sleeplessness.—If this cannot be remedied by hygienic means—such as taking only a light supper, exercise in the open air, and a sponge bath before retiring—and if caused by no obvious physical disorder which can be corrected, one of the alkaline bromides may first be tried alone, and should this fail chloral may be combined with it. Opium is in some cases necessary, but great care should be taken that it is not given so frequently that the habit of using it is formed.

The obstetrician should visit the pregnant woman from time to time, especially during the latter weeks of pregnancy, so that he may know her condition is favorable for her approaching trial. Once a week, during the last two or three months of gestation, the urine should be examined with reference to possible albuminuria; the examination should be made earlier if any symptoms, hereafter to be mentioned, indicate the probability of this disorder being present.

Few women, if a proper explanation be made, will object to an external examination made in pregnancy for obstetric diagnosis. Certainly such examination is advisable in most cases; and in some, where there is the least suspicion of an unfavorable presentation, should be insisted upon. Moreover, if the history of previous labors indicates any pelvic deformity, or there may be other reasons for suspecting such condition, the examination should not only be external but internal also.

CHAPTER VII.

THE PATHOLOGY OF PREGNANCY—INTERCURRENT DISEASES AND TRAUMATISMS.

THE pathology of pregnancy includes, first, those diseases which may happen to the woman in gestation, and which may affect her condition, or be affected by it, in other words, intercurrent maladies, and traumatisms; second, the diseases which are exaggerations of physiological conditions belonging to pregnancy, or otherwise dependent upon the pregnant state; third, affections of the sexual organs; fourth, diseases of the ovum.

Intercurrent Diseases.—Pregnancy brings no exemption from acute, or from chronic disease, and very often a reciprocally injurious influence is exerted by the condition and the disease.

Acute febrile diseases are injurious to the fœtus whenever the temperature reaches 104° F., and remains at this abnormal height. The temperature of the fœtus being normally somewhat higher than that of the mother, it is supposed in these cases to be still greater than her abnormal temperature, and hence its danger. Moreover in some of the acute infectious diseases hemorrhage from the internal surface of the uterus, a hemorrhagic endometritis, occurs which detaches the ovum, and is followed by abortion or by premature labor. Finally, the infection may pass from the mother to the fœtus, endangering or destroying its life, and interrupting the pregnancy.

Acute Infectious Diseases—Typhoid Fever.—Griesinger observed typhoid fever in five pregnant women; all aborted, and three died. In eighteen cases in the hospital at Basle, reported by Liebermeister, abortion or premature labor occurred in fifteen, and of these fifteen six died. Charpentier gives a table including 322 cases, collected from various authors; in 182 of the number abortion or premature labor occurred. He also states that when premature labor results, the child may be still-born, or if born alive it is feeble, and death may occur, preceded by the symptoms of typhoid fever.

Murchison[1] stated that "according to Rokitansky and Niemeyer, pregnancy confers almost entire immunity from enteric fever; but the correctness of this opinion has been denied by Forget, Jenner, Griesinger, and others. I have met with many instances of pregnant females attacked by the disease." He regarded pregnancy as a less serious complication than is commonly supposed. The women generally miscarry, or have premature labor, but recovery takes place in the great majority. Savidan[2] has collected 31 cases of typhoid fever in pregnancy, with five deaths. One of the fatal cases was complicated with

[1] Continued Fevers. Third edition, 1886. [2] Paris Thesis, 1884.

the obstinate vomiting of pregnancy, and another with, probably, acute yellow atrophy of the liver. In typhus fever only about one-half abort, but the majority of these even recover. Murchison's statistics from 1862–70, include 107 pregnant women suffering from typhus under his care; 49 aborted, and nine of these died.

In relapsing fever nearly all the pregnant women miscarry, the fœtus seems to be poisoned by the maternal blood.

In the treatment of a pregnant woman suffering with one of these acute disorders, the importance of antipyretics, especially when her temperature reaches 104° F., is plainly suggested by what has been said as to the danger to the fœtus, as it has a still higher temperature than that of the mother.

Yellow Fever.—Millot[1] notes the fact that when yellow fever appeared, at Livourne, in 1804, the only time it has been seen in Italy, all pregnant women perished of black vomit. In general yellow fever is one of the most dangerous of acute diseases in pregnancy.

I am indebted to my friend,[2] the late Dr. S. M. Bemiss, of New Orleans, for the following conclusions as to the relations of yellow fever and pregnancy:—

1. Pregnancy is altogether indifferent as it regards liability to attacks of yellow fever after exposure. My observations on this point are sufficient to justify an opinion that pregnant women are neither more nor less liable to the disease than the non-gravid.

2. When pregnant women are attacked by yellow fever the danger of fatal results is so much increased, that one might almost say it is exceptional for recovery to occur. But this strong statement of danger ascribable to pregnancy is applicable to severe epidemic visitations and includes all cases treated in hospitals and in the various social conditions of private practice. In recalling the events which have occurred in the ordinary run of private practice in the best districts of this city, I can safely say that I have not lost over thirty-three per cent. of pregnant patients. This is something more than double the percentage of mortality of the non-pregnant. We may therefore safely postulate the danger to the pregnant woman as being double that of the non-gravid.

3. The dangers attending pregnancy are to be ascribed to the great liability to abortion and death from hemorrhage. Perhaps liability to suppression of renal secretion and death from uremia may also be greater. Embolism and thrombosis are quite common events in protracted cases of yellow fever, but I have no recollection of such accidents in any pregnant woman in my practice.

4. The pregnant woman, being attacked by yellow fever and recovering without miscarriage, immunity from future attacks is conferred upon the offspring contained in the womb during the attack. This is an extremely interesting proposition. I regret that I have only three accurate observations which support it, but I believe that further investigations will confirm its truth.

5. The recently delivered woman is more liable to be attacked by yellow fever than one differently circumstanced, both being equally exposed. I

[1] Op. cit.

[2] Dr. Bemiss, as will be at once admitted by all who knew this excellent man and wise physician, was eminently careful and conscientious in his investigations, and hence his conclusions may be readily accepted.

cannot establish this proposition by any indisputable facts. It is a current belief among those who have observed much yellow fever, that traumatic conditions invite attacks of yellow fever. My own observations support this opinion, and more especially as it relates to the parturient woman.

6. The recently delivered woman being attacked by yellow fever, encounters an increased degree of danger nearly or quite equal to that of the pregnant woman.

Intermittent Fever.—It is a mistake which some have made, to regard pregnancy as furnishing any immunity from malaria. The opposite opinion, that is, the condition creates an increased liability to the occurrence of its manifestations, is more probable.

Torti,[1] Doublet,[2] and Osiander,[3] have mentioned the occurrence of intermittent fever in pregnant women; Doublet spoke of it as quite frequent.

Göth's statistics, quoted by Charpentier, show that forty-six of eight hundred and eighty-one pregnant women suffered from malarial attacks; of the forty-six, five miscarried, fourteen had premature labor, and in only twenty-seven the pregnancy was uninterrupted.

Bonfils[4] has collected 140 cases, many of them unpublished. In very many premature labor occurred, but in very few abortion. He found that chronic malarial poisoning manifested its influence especially by the death of the fœtus, and by the insufficient development of the fœtus. In regard to the last point, the weight of the fœtus was found to be 500 grams under the normal, and its length ten centimetres less than the normal length.

One of the curious[5] facts asserted by different observers, is that the fœtus may suffer with intermittent attacks, occurring at the same time with those of the mother; in some instances the attacks have continued after birth, and in all the child had at birth an enlarged spleen.

Goodell and Harris[6] have "related cases where the fœtus seemed to have been affected by the malarial poison, the mothers stating that they were aware of periodical convulsive movements of the children, their own system being apparently unaffected."

In nine cases the fœtus was thought to be affected by malarial poisoning while in the uterus, according to Bonfils.

The treatment of intermittent fever in pregnancy is the same, so far as the administration of antiperiodics is concerned, as if the patient were not pregnant. There need be no hesitation in giving quinine, for example, and giving it freely, unless some idiosyncrasy forbids its use. Dr. Henry F. Campbell[7] refers to "the thousands of pregnant women who daily use the drug to prevent or break the force of par-

1 Therapeutice Specialis ad Febres Perniciosas, Venice, 1709.
2 Nouvelles Recherches de la Fievre Puerpérale, Paris, 1791.
3 Beobachtungen Abhandlung und Nachrichten. Tubingen, 1787.
4 Paris Thesis, 1885.
5 Bouchut, *Traité Pratique des Maladies des Nouveau-Nés*, after narrating cases of intrauterine intermittent, which have been stated by Schurigius, Stokes, Hawelka, and Aubanais, says: "I do not discuss these extraordinary facts. I neither accept nor reject them, but only wait for future observations to decide whether they are true or imaginary."
6 American Journal of Obstetrics, vol. ii.
7 Transactions of the American Gynæcological Society, vol. v.

oxysms of fever," without its ever entering the mind of patient or of physician that it has any influence in interrupting pregnancy. If abortion or premature labor follow the use of quinine in malarial fever, the result is that of the disease, not of the medicine.

Cholera.—Pregnancy neither exempts from, nor predisposes to cholera. Kleinwächter states that this more frequently than any other epidemic disease attacks the pregnant woman, especially in the later months. Abortion or premature labor is caused in about 60 per cent. According to some the fœtus, too, may have cholera. The death of the fœtus if not due to the cause just mentioned, has been attributed to the cramps and spasmodic movements of the abdominal muscles of the mother, producing mechanical pressure; to the absolute diet to which she is subjected; to the loss of the serous portion of the blood, making it unfit for nutrition; some regard asphyxia as the chief, if not the sole cause of the death of the fœtus; Kleinwächter conjoins with it the great loss of the water of the blood, and the lessened blood pressure. The prognosis for the mother is also bad, but the pregnant condition furnishes no special therapeutic indications.

Variola.—This is the most grave of acute infectious diseases which may attack the pregnant woman. According to Curschman[1] her condition causes a certain predisposition to the disease, and increases its malignancy. The danger to mother and fœtus is very slight in varioloid, but in variola, if confluent, abortion or premature labor usually occurs, and is followed by the death of the mother. If a pregnant woman has the disease, the rule is that her fœtus is also affected, and it may pass through all the stages of the disease in the uterus; in some instances it is born with the disease, while in others it is born apparently well, but is attacked soon after birth. In rare instances an apparently healthy mother gives birth to a child having variola; Curschman explains such cases by the hypothesis that the mother had "variola sine exanthemate," and thus infected the child. When mother and fœtus are both affected, the disease begins earlier in the former, the latter not being attacked until the suppurative stage has begun in the mother. The disease may appear in the fœtus as early as the fourth month. In twin pregnancy, one fœtus may be born with the disease, while the other is entirely free from it.

When the infection takes place early in pregnancy, the dead fœtus is usually expelled in three or four days, but it may remain for as many weeks. In some cases the disease is so severe that the woman dies very early without aborting, or having premature labor. The further advanced a woman is in pregnancy, the greater the liability to the disease, and the greater its gravity.

The death of the fœtus is explained by its being affected by the disease, by the high temperature, or by the hemorrhagic endometritis. Accumulation of carbonic acid in the blood is, according to Brouardel, also a cause; such accumulation, too, excites uterine contractions.

Vaccination of the pregnant woman, if she has not been recently

[1] Ziemssen's Encyclopædia.

vaccinated, ought to be done when there is the slightest danger of her being exposed to the poison of variola.

Scarlatina.—This disease, several times observed in the puerperal, has been rarely seen in the pregnant woman. Nevertheless it is probable, as suggested by Hervieux,[1] after mentioning a case under his own care where scarlatina occurred in a woman six months pregnant, and caused abortion, and a similar one observed by Dance, that a great number of other cases of the disease occurring in pregnancy have escaped being properly recorded, but from the fact that the disease caused abortion or premature delivery, have been regarded as belonging to the puerperal rather than to the pregnant state.

The pregnant, as well as the puerperal condition, adds to the danger of the disease. In an epidemic of scarlatina which occurred in Vienna in 1801, abortion occurred in all pregnant women who were attacked, and the majority died. (Bourgeois.)

Thomas[2] states that the mortality of scarlatina in adults is greatest in pregnant, in puerperal women, and in invalids.

Rubeola.—The number of reported cases of measles in pregnancy is small. Gautier has collected a few,[3] among which is one from Fabricius of Hildanus, having considerable interest. The patient of Fabricius was attacked by measles in the middle of the ninth month of pregnancy, and the fourth day of the disease gave birth to her child, which was covered with the eruption of measles. In a case under my own care, the patient being also in the ninth month of pregnancy, premature labor occurred the third day after the eruption appeared; the child was born apparently well, but in a few days had measles, and the disease proved fatal; the mother recovered. Gautier's conclusions are that the disease predisposes to miscarriage by causing the death of the fœtus, and that it is not without danger to the mother. Underhill's conclusions are not materially different,[4] but he especially emphasizes the danger to the mother.

Chronic Infectious Diseases—Phthisis.—The statistics[5] of the late Dr. Austin Flint, as well as the investigations of Gaulard,[6] show that a large per cent. of women become phthisical during pregnancy. The former has stated that in 11.5 per cent. of women under forty years of age who are affected by phthisis, the disease is developed during gestation, and in $13\frac{69}{87}$ per cent. soon after confinement. According to Gaulard the puerperal state and lactation determine phthisis in at least three-fourths of the cases of the disease in women. The late Dr. George B. Wood[7] taught that the occurrence of pregnancy, undoubtedly in many instances, arrests for a time the progress of the disease, and that lactation appears to exercise a favorable influence over it. He even held that the disease might be kept at bay for many years by child-bearing and nursing, so that occasionally the predisposition appeared to be overcome. Dr. Flint's statistics indicate that in the

1 Maladies Puerpérales.
2 Ziemssen's Cyclopædia.
3 Annales de Gynécologie, 1879.
4 Obstetrical Journal of Great Britain and Ireland, 1880.
5 Phthisis.
6 Quoted by Charpentier.
7 Treatise on the Practice of Medicine.

majority of cases pregnancy does not show an unfavorable influence. Quite recently James[1] has maintained that pregnancy has a favorable effect upon phthisis, but that labor and lactation are undoubtedly injurious. But, as Stoltz has said,[2] it is not probable that an exhausting function which involves the entire economy will spare a diseased organ. In many cases the phthisical succumb some weeks or some days after premature delivery. The cases are exceptional where the health seems to be, or is temporarily, benefited by pregnancy. "The children born of phthisical mothers are usually feeble, often at first become scrofulous, and subsequently tuberculous."[3]

Syphilis.—Fournier regards pregnancy as a complication of syphilis:[4] "It complicates it by adding to it its own peculiar anæmia, its debilitating influence, its disposition to neuroses, its disorders of nutrition, etc." Abortion or premature labor is a very common consequence of syphilis. Thus, out of 414 pregnant women at Lourcine, only 260 arrived at term. Abortion from syphilis is not produced alone in coincidence with cotemporary syphilitic manifestations;[5] it often, very often, occurs independent of all actual accident, as an isolated phenomenon, as the sole expression of the diathesis.

The secondary stage of the disease is that which furnishes the greatest liability to abortion; from the fourth month to the end of the second year is, according to Fournier, the time when syphilitic abortions most frequently occur. Thus, a woman who, being syphilitic, becomes pregnant, is more liable to abort than one who, being pregnant, becomes syphilitic. If the contagion is communicated at the time of the impregnation—that is, the fecundating is the infecting coition—there is great danger of abortion; but if the poison is received after the fourth month, the danger is slight, and almost nothing if the infection occurs toward the close of pregnancy. According to excellent authorities the father may beget syphilitic offspring without the mother being affected. Again, it is held by some, Fournier among the number, that the disease may be transmitted by the fœtus to the mother. The antisyphilitic treatment is indicated in pregnancy if the father be syphilitic, even though the mother has had no manifestations of the disease, but still more if she has such manifestations.

Non-Infectious Sporadic Diseases—Pneumonia.—This is a much more frequent disease of the male than of the female, but in the latter has a one-third greater mortality. It is not a common disease in pregnancy. Devilliers and Matton,[6] however, regard the increase of fibrin in the blood as predisposing to it, but this could only be the case in the latter part of pregnancy. The disease is one of great gravity both for the mother and for the child. The high maternal temperature, want of proper oxygenation of the blood, and a less supply of blood to the placenta explain the dangers to the fœtus. A greater mass of blood in the pregnant woman to be purified, and greatly lessened space for its purification, indicate the danger of the disease to the

[1] Edinburgh Medical Journal, 1886.
[2] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xvii.
[3] Gaulard.
[4] Leçons Cliniques sur la Syphilis, second edition, 1881.
[5] Fournier.
[6] De la Puerpéralité, par le Dr. Raymond.

mother, the lungs made hyperæmic in the effort of the right ventricle to overcome the difficulty, and possibly œdema resulting from the hyperæmia.

Pregnancy is more liable to interruption the farther it is advanced when the disease occurs. If abortion or premature labor occur, one-half the mothers die; but if the pregnancy continue, only one in between five and six dies. Martin[1] confirms the statement of Ricau,[2] derived from statistics, that a pneumonia before the one hundred and eightieth day is least dangerous for the mother and the fœtus. Ricau found that in 28 cases of pneumonia in pregnant women, 23 recovered, 6 with, 17 without miscarriage; of 15 others with pneumonia after the one hundred and eightieth day, only 8 recovered, 5 with, 3 without miscarriage, while 7 died.

Chatelain's statistics,[3] quoted by Lepine, include 39 cases. In 10 abortion occurred, and in 9 premature labor was induced; of the 19, 10 died, and of the remaining 20, 10 also died, the entire mortality being nearly 50 per cent. Ricau states that when pneumonia occurs in the last three months of pregnancy, half the patients die, while death is the exception if the disease occur in the first six months.

Some have advocated the induction of abortion or of premature labor in the treatment of grave cases of pneumonia. Upon theoretical grounds such treatment has been condemned. The evacuation of the uterus, as Kleinwächter has said, suddenly reduces the intra-abdominal pressure, but even if the diaphragm be immediately given greater range, which he doubts, with every inspiration there is a greater flow of blood to the numerous venous branches of the thorax, and also permanent increase of pressure in the pulmonary vessels, and an increased load of venous blood is thrown upon the pulmonary arteries when a considerable portion of the lung is unfit to decarbonize the blood. Charpentier believes that the induction of labor ought not to be absolutely rejected, but reserved for special cases. If all treatment has failed, and the life of the mother is seriously compromised, she ought not to be refused the chance afforded her. "All authors agree that emptying the uterus effects, at least momentarily, a diminution of the pulmonary congestion, of the dyspnœa, and consequently a great relief to the patient. This relief may be transitory, but still it is a benefit to the patient, and the infant being almost inevitably doomed by the disease, the interest of the mother alone is to be considered." The argument is stronger if the pneumonia be double, or if the patient be also suffering from cardiac disease. After the abortion or premature labor the patient, if she does not recover, dies within two or three days.

Pleurisy.—This disease usually terminates favorably, and does not disturb the pregnancy. But if bronchitis be associated with it, or if the pleurisy be double, abortion or premature labor may result. Nevertheless, in all cases pleurisy is a more serious disease in the pregnant than in the non-pregnant, because the effusion for the time lessens the

[1] Zeitschrift für Geburtshülfe und Gynäkologie, 1885. [2] Paris Thesis, 1874.
[3] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxviii.

pulmonary capacity, which is of course a greater evil to the former than to the latter. Thoracentesis has been done in pregnancy without any injurious effect upon it.

Jaundice.—This disease may occur in pregnancy in either one of two forms, simple or malignant. The first, observed in the later months, is attributed by Frerichs[1] to pressure of the enlarged uterus, or of the colon distended by fecal matter, upon the bile-duct. Bedford[2] suggests that jaundice in pregnancy may sometimes be in part due to strong mental emotions. The second form of the disease, malignant jaundice, may occur much earlier than the simple form, and is dependent upon very serious structural disease of the liver.

Peter[3] explains the jaundice of pregnancy as resulting from an exaggeration of the physiological hyperæmia of the liver. According to Tarnier the liver of a woman dying in pregnancy or in childbed is enlarged, and there is fatty infiltration between the cells. It is an organ for the elimination of ternary compounds, and its work is greatly increased in pregnancy. When the elimination is deficient, infiltration occurs. "But apart from the benign, there is a malignant jaundice of pregnant women. Some women having a benign jaundice up to a certain time, are suddenly attacked by accidents which rapidly end in death, and which characterize malignant jaundice. This jaundice is the poisoning of the organism by the accumulation in the blood of bile materials uneliminated by the diseased liver, a poisoning which I call cholemic typhisation."

Acute yellow atrophy of the liver, which is present in malignant jaundice, is supposed to result from a constitutional affection. Buhl regards the hepatic disease as one of the evidences of impaired nutrition of the entire organism. Wunderlich considers the destructive process in the liver to be caused by an acute pernicious constitutional affection. Duncan[4] states the disease is not seen oftener than once in 10,000. Its greater relative frequency in pregnant women, and its progressing so rapidly, have been attributed to the fact that pregnancy predisposes to parenchymatous degeneration of the glandular organs, especially of the liver and of the kidneys.

The statistics of Frerichs show not only that females are more liable to the disease than males—in 31 cases, 22 were females—but also that pregnancy was a predisposing cause, one-half of those attacked being pregnant. Spaeth, finding only two cases in 33,000 pregnant women, concluded that the disease was extremely rare. But Ollivier[5] has said in reply, that women suffering from jaundice in pregnancy would be received into general hospitals, and not enter maternities, and that recent observations have shown that grave jaundice in pregnant women is not so rare as those statistics indicate.

The disease has occurred as an epidemic, and is then peculiarly fatal. In nearly two-thirds of the cases abortion or premature labor occurs. Dr. J. W. Underhill[6] regards it "as doubtful whether a well-authenti-

[1] Clinical Treatise on Diseases of the Liver.
[2] Obstetrics.
[3] Clin. Médicale.
[4] Clinical Lectures on Diseases of Women.
[5] Archives Générales, 1873.
[6] Transactions of the American Gynæcological Society, volume vi.

cated case of malignant jaundice occurring in gestation has recovered." On the other hand, Charpentier presents a table of 68 cases; 42 of these patients miscarried, and of these 30 died, and 12 recovered, while the remaining 26 were delivered at full term.

Premonitory symptoms are observed in one-half the cases. They may precede the serious manifestations of the disease two or three weeks, but usually only three to five days; they generally indicate acute catarrh of the stomach and bowels. The jaundice is slight, and, Duncan states, may be absent. "The jaundice is not like that which you know familiarly as the common jaundice; it is a much slighter condition of tinting, and in the cases of icterus gravis I have seen never has proceeded to be a deep yellow. The disease should not be called jaundice or icterus at all; it is a disease which affects the whole body, and whose best-known manifestations are in the liver."[1] Great nervous excitement, generally violent pain in the head, delirium, and convulsions are succeeded by prostration and stupor, and then a coma which ends in death. Abortion or premature labor usually precedes death; in some cases the disease is so rapidly fatal that the uterus does not discharge its contents.

Treatment.—The mild form requires little or no medication. It may be advisable to give laxatives, and direct an occasional warm bath; in some cases diuretics to assist the eliminating action of the kidneys may be useful. In the grave form of the disease, Duncan suggests emptying the uterus as the only thing in the way of treatment. But Charpentier, in view of the disastrous results which have been seen to follow abortion, regards the induction of abortion, or even of premature labor, as out of the question. Cazeaux advises that the woman change her residence. But if already attacked, this change could do no good.

Diseases of the Heart.—As has been previously stated, hypertrophy of the heart is a normal phenomenon of pregnancy. But this hypertrophy involves especially, if not exclusively, the left ventricle, for, as stated by Peter, the resistances to be overcome are greater in the department of the aorta than in that of the pulmonary artery. Moreover the hypertrophy is usually transitory, disappearing after pregnancy. But it is possible, as has been suggested, that in some cases normal cardiac, like uterine involution, may be imperfect, and the persisting hypertrophy may increase with recurring pregnancies, especially if the recurrence be rapid. Now the tendency of hypertrophy of the left heart is to change the diameter of the aortic, and that of the mitral orifice, and hence valvular insufficiency may result.

It is probable that a pathological condition thus induced is exceptional. The cardiac disease in most cases is rheumatic in origin, and antedated pregnancy, but the latter reveals the former, that is to say, a crippled heart may cause no serious disturbance in the non-pregnant condition, but when pregnancy occurs it is unequal to the increased work thrown upon it, and what Peter has first called cardiopathic accidents result.[2] The pregnant woman's heart, it has been said, beats

[1] Duncan, op. cit.
[2] Maladies du Cœur, et de la Crosse de l'Aorte, par Michel Peter, 1883.

for two, as her lungs breathe for two. "There is consequently greater pressure in the vascular system of these organs, a necessary congestion, and this new anatomical condition resulting from the needs of hæmatosis for two gives a satisfactory explanation of the suffocations which some pregnant women experience, and of the pulmonary hemorrhages which occur in others." Peter says that not only is the blood-distribution interfered with, but also the blood-making by the cardiac lesion, and hence the nutrition of the fœtus is doubly compromised since it receives with greater difficulty a blood which is more imperfect. In fourteen cases reported by him, the form of lesion in almost all was mitral insufficiency with or without stenosis, and once only in the fourteen was there aortic insufficiency. The time when gravido-cardiac accidents begin, or become very intense, is from the third to the sixth month, generally in the fifth. According to MacDonald[1] serious symptoms do not usually appear until after the middle of pregnancy; they are apt to be aggravated by exposure to cold or by exertion, and patients suffering from severe cardiac lesions almost always are delivered prematurely.

While the statistics of observers confirm the statement of Peter as to the lesion being more frequently mitral than aortic, yet they do not make the proportion so great as his statistics did. Thus Berthiot[2] gives only 22 out of 36 as mitral; Porak[3] found 57 mitral, 22 complex, and 13 aortic.

Porak groups the cardiac disorders of pregnancy in four classes:—

1. The first type is marked by disturbances of cardiac innervation; there is more or less irregular palpitation increasing with the advance of the pregnancy, and accompanied by dyspnœa; there are attacks of oppression, sometimes slight and transient, at other times violent, accompanied by vertigo, headache, præcordial pain, but without pulmonary stethoscopic sign.

2. The second, the most frequent type, often complicating the first, is characterized by pulmonary congestion and œdema which become greater with the advance of pregnancy, and may be accompanied by hæmoptysis, apoplexy, pulmonary infarctus, epistaxis, hæmatamesis.

3. The third type is expressed in a single word, *asystole*, an asystole which may be more or less pronounced, and consequently cause more or less disturbance in the general circulation. The graver the troubles of this type, the greater the probability of œdema, of serous visceral effusions, ascites, hydrothorax, hydropericardium, and concomitant lesions of the kidneys and the liver.

4. The fourth type is constituted by emboli, which, according as they pass to the liver, the kidneys, or the brain, produce various lesions.

Gravido-cardiac accidents are rarely seen in first pregnancies, but their frequency and severity increase from the second in subsequent pregnancies. The danger from cardiac disease is greatest, probably, in labor; after labor the disorder is lessened. The greatest danger occurs when the cardiac lesions are complex. The lesions ranking

[1] Chronic Disease of the Heart in reference to Pregnancy and Parturition.
[2] Grossesse et Maladies du Cœur. [3] Quoted by Charpentier.

next in point of peril are mitral; MacDonald and Porak regard mitral stenosis as presenting the greater, mitral insufficiency the less risk. Aortic insufficiency is extremely dangerous in the latter months of pregnancy and in labor, but provided the delivery is safely accomplished, the threatening symptoms disappear. The liability to abortion or to premature labor, and to hemorrhage, is very great in the cardiopathic. The placenta is in some cases diseased.

Hygienic Treatment.—Peter states that a woman with disease of the heart had better not marry. If she is married, she ought not to be a mother. If she has once or twice become a mother with impunity, she ought not to have another pregnancy. If safely delivered, she ought not to nurse her child.

Obstetric Treatment.—Berthiot advises auscultating the heart of a pregnant woman, so that if disease be discovered means may be taken to guard against its accidents. If serious accidents arise before the child is viable, it is justifiable to empty the uterus, and still more is this action right if the period of viability has been reached. When labor occurs, either spontaneously or artificially, art should, as far as can be done without violence, replace uterine and voluntary effort in effecting delivery.

The following history of a case of pregnancy and labor in a cardiopathic, recently under my care in the Philadelphia Hospital, is given by my interne, Dr. H. B. Allyn:—

R., æt. 28, somewhat under the average height, enjoyed good health until three years ago, when she suffered from cardiac disease, probably the result of inflammatory rheumatism. Her present pregnancy is the fourth, but the first since heart disease developed. Examination of the heart, made February 9, gave the following results: Apex beat in nipple line. Pulsation seen in vessels of neck. Heart's action irregular and intermittent. First sound of heart over aortic cartilage altered, but no distinct murmur is heard. Over mitral area there is a presystolic murmur and thrill, most distinct in third left intercostal space, one inch to left of sternum. The patient subsequently developed and became subject to attacks of dyspnœa that were so severe as to threaten life. On the 14th of February she passed an unusually distressing day, so that premature labor was thought of as a relief, but before the arrival of Dr. Parvin, at 10 P. M., labor had spontaneously begun, and was completed by craniotomy at 3 A. M. on the following morning. The child, of course, without the brain, weighed seven and a quarter pounds, the placenta, etc., one and a half pounds. During the afternoon of the 14th albumen was found in the urine, and though it persisted and casts were present, convalescence progressed rapidly. I have seen the patient several times since her discharge from the hospital, and have found her as comfortable as one with her degree of cardiac disease can be expected to be.

A word or two should be added in regard to the obstetric treatment. The general rule in such cases is, as has been stated, to replace by art uterine and voluntary effort, as far as can be done without violence. This patient's breathing was so difficult, her face anxious, her skin

dusky, and her pulse so rapid and feeble, I thought she could be given some relief by rupture of the membranes; this was done when the os was not more than one-third dilated, and a very large quantity of amniotic fluid was discharged, so large indeed that it seemed probable the child would be less than the usual size, a probability, however, which was not verified. The patient had much less discomfort after the membranes were ruptured. Dr. Allyn employed artificial dilatation; after this was completed the head failed to enter the inlet, then an effort was made by him, with my assistance, to deliver by forceps, first with Simpson's, then with Tarnier's; it was impossible to bring the head into the cavity. Upon introducing my hand I found the head lying in a transverse position above the inlet, and the cord which was partially prolapsed was pulseless; as nearly as I could judge the antero-posterior diameter of the inlet was less than four inches. But independently of any pelvic narrowing, the child being dead, and the condition of the mother requiring immediate delivery, craniotomy was resorted to.

Disease of the heart does not necessarily contra-indicate anæsthesia in labor. Macdonald[1] claims that chloroform is useful, in that it prevents bearing-down efforts. Vergely, quoted by Dutertre,[2] states that cardiac diseases do not forbid the use of an anæsthetic in labor, and chloroform acts as a sedative to the heart in these affections, and may be given prudently. Barr[3] believes that obstetric anæsthesia has a beneficial sedative action upon the heart.

Chorea.—This affection, much more frequent in the female than in the male—the proportion, according to Simon, being three to one—is seldom seen in pregnancy. In 1868 Barnes[4] could find but 56 cases of chorea as a complication of pregnancy. Fehling, in 1874, found 68 cases. Charpentier remarks that in 1600 deliveries at the Clinique he found but two cases of chorea, but recently he has seen a third, in which, however, the disease appeared after delivery. The liability to the disease is greater in first than in other pregnancies; the larger number of those affected are between twenty and twenty-five years of age. Chorea may occur in a first and not in a subsequent pregnancy, or it may be manifested in several pregnancies. Previous attacks of the disease, as in childhood, create a liability to it. It usually begins in the first half of pregnancy and continues through the pregnancy; in rare instances it still remains in the puerperal state.

Barnes considers the disease is chiefly dependent upon an altered condition of the blood, but states that in addition to this there is an antecedent condition, a predisposing cause, the nature of which is a matter of speculation. Spiegelberg regarded the cause of chorea, except in cases where a central lesion exists, and others of an hereditary character, as imperfectly understood: "Occasionally it is found in connection with disease of the heart and rheumatism, and possibly some of the central lesions may be connected with embolic processes conse-

[1] Op. cit. [2] De l'Emploi du Chloroforme dans les Accouchements Naturels, 1882.
[3] American Journal of Obstetrics, 1880.
[4] London Obstetrical Society's Transactions, vol. x.

quent upon cardiac disease. In many cases no clearly defined cause can be found, and these may be considered reflex neuroses, which may be developed under the influence of predisposition, insufficient nutrition of nerve centres from impoverished blood, and the peripheral irritation from the sexual organs."

Psychical causes—such as fear, sorrow, and anxiety—often have a marked influence in determining an outbreak of the disease. Mundé reports a case in which he attributed the disease to anemia, mental anxiety, and the hyperæsthetic condition of pregnancy.[1] On the other hand, Trousseau has recorded a case in which chorea ceased with the occurrence of pregnancy.[2] Chorea may begin gradually or suddenly. In most cases the movements are bi-lateral, and in almost all they cease during sleep. The mortality of chorea in children is, according to Sée, 5.7 per cent., while according to the statistics of Wenzel, it is 27.3 per cent. in pregnant women. Spiegelberg found in 84 cases 23 deaths. Death occurs from the complications rather than from the disease itself. Chorea in many cases causes abortion or premature labor.

Treatment.—The medical treatment includes tonics, the alkaline bromides, opium, hypodermatic morphia, and chloral. Wade[3] narrates a case in which digital dilatation of the os uteri was successful in curing the patient, the pregnancy being uninterrupted. If the fœtus be viable, and the usual means for the relief of the disease have been faithfully tried without benefit, the choreic movements are violent, and the patient's strength is failing, the induction of labor is generally considered by obstetricians advisable. But whether cases occur in which abortion is proper is still an unsettled question.

Hysteria.—Notwithstanding the Father of Medicine advised marriage as the remedy for hysteria, the value of this treatment has not been confirmed by modern observation. In regard to the influence of pregnancy upon hysteria, no absolute rule can be given, but certainly it does not cure it. In the earlier months the hysterical attacks are usually more frequent and severe, while in the later months the opposite is often seen. Raymond[4] states that the hysterical may pass through labor without suffering as a common fact which has been mentioned by a number of authors.

Epilepsy.—In some cases of epilepsy the convulsive attacks during pregnancy are less frequent, but after the pregnancy ends they resume their former frequency; in others no change is observed, while in still others the attacks are more severe. In one case under my own care the attacks were less severe and frequent during the pregnancy, but after puerperal convalescence they became again as severe and frequent as they were prior to pregnancy.

Traumatism.—This includes injuries, whether accidental or intentional, received by the pregnant woman, and surgical operations performed upon her. The subject has been especially studied in recent

[1] American Journal of Obstetrics, 1882. [2] Bulletin Gén. de Therap. 1846.
[3] London Obstetrical Society's Transactions, volume xxii.
[4] Op. cit.

years by Cohnstein,[1] Guéniot,[2] Verneuil,[3] and Mann.[4] It presents two aspects, the influence of traumatism upon the pregnancy, and that of pregnancy upon the traumatism.

In considering the first of these topics one cannot but be struck by the fact that pregnant women have endured severe accidents, or grave surgical operations without the pregnancy being interrupted. Thus fractures of the lower limbs, of the pelvis, and even of the vertebral column have occurred in pregnancy, and miscarriage was not produced. In one instance a woman seven months pregnant jumped from the third story window to the pavement, breaking her legs and her arms, but labor did not ensue until the normal time. Amputation of limbs, disarticulation of joints, ovariotomy, herniotomy, removal of a diseased breast, and amputation of the cancerous vaginal cervix have been done without affecting the course of the pregnancy. On the other hand, minor operations upon the rectum or the anus, upon the perineum or the vulva, and slight accidents have been followed by abortion. Cohnstein states that penetrating wounds of the abdomen caused by falling on a fork, by injury from a scythe, or from the horn of a bull, even though the uterus be intact, usually arrest pregnancy. In cases where the pregnancy continues the wound has healed readily; in that reported by Fricke cicatrization took place after sixteen days.

Three cases of gunshot wounds of the pregnant uterus are given in the writer's contribution to the *International Encyclopædia of Surgery*, these cases being reported by Richard, Staples, and Hays. The pregnancy was arrested in all; in one a living child was born, and all the mothers recovered. Guéniot's conclusions as to the influence of traumatisms upon pregnancy are as follows:—

1. The harmlessness of traumatism in pregnancy is not governed by any absolute law.

2. A traumatism, if the woman be without morbid predisposition, she, her uterus, and the ovum healthy, is generally without injurious effect upon the pregnancy.

3. If gestation be complicated with a pathological condition, such as abnormal irritability of the uterus, disease, or great size of the ovum, albuminuria, etc., the traumatism, however slight, and whatever the part involved, most frequently causes premature expulsion of the ovum.

4. Great caution is advisable in performing surgical operations during pregnancy.

Guéniot further states that a surgical operation involving the genital zone is, except in urgent cases, contra-indicated by the state of gestation. Sir James Paget[5] states that while, on the one hand, it would be mere recklessness to operate on a pregnant woman without good cause, yet if good cause for operation exists she may be treated very successfully. Verneuil gives several important rules to guide the surgeon in deciding as to an operation during pregnancy; he also strongly

[1] Ueber Chirurg. Op. bei Schwang.
[2] Annales de Gynécol., tome vi.
[3] International Encyclopædia of Surgery, volume i.
[4] Transactions of American Gynæcological Society, 1883.
[5] Clinical Lectures and Essays.

condemns operating during the puerperal state. In case of danger, he advises operating during pregnancy; and, under opposite circumstances, postponing interference until a period sufficiently remote, two to four months, from delivery. Among Mann's conclusions are the following:—

Operations on the vulva cause little danger to the mother or the child, while those on the bladder are not at all dangerous. Operations on the vagina are likely to cause severe hemorrhage, but are not otherwise dangerous, while those upon the rectum involving the anal sphincter are. Operations upon the perineum and upon the cervix may be done in the earlier months of pregnancy with a fair prospect of success.

Notwithstanding the results derived from Mann's statistics, it is better safer to postpone in pregnant women until after puerperal convalescence all operations, whether involving the sexual organs or not, unless there be an urgent necessity for operating, as, for example, in some cases of malignant disease or of ovarian tumors.

CHAPTER VIII.

THE PATHOLOGY OF PREGNANCY (*Continued*)—DISEASES THAT ARE EXAGGERATIONS OF PHYSIOLOGICAL CONDITIONS OF, OR OTHERWISE DEPENDENT UPON, PREGNANCY.

Hyperemesis: obstinate, incoercible, uncontrollable, pernicious vomiting of pregnancy. The very common occurrence of some gastric disturbance in the earlier months of pregnancy has been mentioned, and also the hygienic and medical treatment of the less severe cases of the disorder given. We are now concerned with the exaggeration of this affection, an exaggeration which in some cases may be so great that not only the pregnancy but the life of the woman is imperilled.

Kleinwächter[1] remarks that the German literature contained so few cases of this disease, that Hohl denied its occurrence. Duncan[2] refers to two kinds of vomiting in pregnancy: one resulting from morbid innervation as frequently very grievous, and perhaps sometimes fatal; and the other more persistent, sometimes proving fatal suddenly and unexpectedly, resulting from acute yellow atrophy of the liver. This apparent scepticism as to the grave vomiting of pregnancy, occurring independently of acute yellow atrophy of the liver, an affection which is exceedingly rare, will not be shared by the majority of practitioners.

In about two-thirds of the cases of hyperemesis of pregnancy the disease begins before the end of the third month. In most patients there is at first a gradual passage of the ordinary nausea and vomiting into the severe form of the disorder, and the patient's stomach rejects the simplest food, liquid or solid, in a short time after it is taken. It may be you see her take even only ice-water, but with eagerness and relish, and you congratulate her upon retaining it, but her previous experience leads her to reply, "No, it will come up as soon as it gets warm," and the event in a short time proves the prediction. There may be copious secretion of saliva associated with the emesis, and the dribbling discharge annoys the patient night and day. Change of position, as from the back to the side, or the reverse, will often be the exciting cause of vomiting. The tongue becomes dry, the gums spongy and bleeding, the breath offensive, the thirst excessive, and the urine scanty and high-colored; the pulse is 90 to 100, or even more frequent. The inability to retain food, and the loss of rest, for even the night gives no intermission to, scarcely remission of, the vomiting, and the distressing nausea result in a rapid emaciation and loss of strength; the patient, necessarily confined to her bed, may faint upon attempting to stand, or even upon sitting up; her face is sharp, hag-

[1] Op. cit. [2] Clinical Lectures.

gard, sometimes of a dusky hue, or oftener remarkably pale; her eyes sunken, the skin often cold and clammy; prostrate, and almost utterly hopeless, she may be willing or eager, as relief from her prolonged and severe suffering, to welcome death, whose shadow seems to be resting upon her.

In the above sketch, an endeavor has been made to represent the condition of a patient under my care a few years since. She was in her third pregnancy; the two previous ones, I was not then her physician, had been ended by artificial abortion, though the symptoms, according to her own and her husband's statement, were not so grave as now presented. Her condition was so serious that an able and estimable practitioner who saw her in consultation with me, thought that the induction of abortion furnished the only hope, and probably this had been delayed too long. Nevertheless the patient recovered. The vomiting gradually ceased in the sixth month, and at the end of the normal period she gave birth to a healthy, well-developed male child.

But the result is not in all cases so fortunate. Diarrhœa may occur, and hence the emaciation and exhaustion are more rapid and extreme. The patient passes into the second stage of the disease in which the grave symptoms previously given become graver; fever is now manifested, and this is the most characteristic symptom; in some there is acute pain in the head, in the epigastrium, or in one or the other hypochondrium; "the emaciation is frightful, and attacks of syncope are frequent." The third stage succeeds. Vomiting ceases, but fever increases; the pulse is from 120 to 140, and is small and thread-like; mental disorder is shown in hallucinations and delirium, and coma closes the scene.

The duration of the disease is in most cases from two to three months. Of the 118 cases collected by Guéniot, 46 died. In the third stage, a fatal result is almost inevitable. The disease is, in some instances, complicated[1] with pulmonary tuberculosis, intestinal catarrh, or round gastric ulcer. In some cases spontaneous abortion occurs, and if the patient be not too exhausted, convalescence follows. The vomiting dependent upon the pregnancy should not be confounded with that which may be caused by albuminuria, cancer of the stomach, or tuberculous meningitis; these mistakes have been made.

Causes.—The etiology of the vomiting of pregnancy, whether this vomiting be mild or severe, is obscure. Various theories have been proposed. That which has been generally received is, that the gastric disorder is sympathetic;[2] that is, it is caused by sympathy between the uterus and stomach. We now substitute reflex for sympathetic, but thereby add nothing to our knowledge in explaining the phenomenon. The explanation most commonly received has been stated on page

[1] Kormann.

[2] The term sympathetic can be more appropriately applied to the nausea and vomiting of the husband as a consequence of his wife being pregnant, and thus suffering. Seeing another vomit, especially if there be a strong attachment for the one thus affected, and especially, too, if the vomiting be very frequent, may cause vomiting. Possibly, too, there is something to be attributed to unconscious imitation in marital vomiting. Certainly the few facts illustrating this disorder in the husband are not to be regarded as wonderful and mysterious, but admit of a very simple explanation.

217. Violent vomiting is also observed when the pregnant uterus is subject to severe internal pressure, or when the organ has become incarcerated in the pelvis. Hewitt has dwelt especially upon versions and flexions of the uterus as causes. Bennet asserts an important connection between inflammation of the neck of the womb and the vomiting of pregnancy; circumscribed inflammation of the body of the womb is a cause according to others; rigidity of the tissues of the cervix, or adhesion of the membranes at the internal os, are causes given by still others. While the influence of at least some of these will be admitted in individual cases, there are cases where none of them are present. According to Lebert and Rosenthal, in some cases the nausea and vomiting are nervous, partial manifestations of a general nerve inanition. Barnes refers to the stomach as not the seat of the disease,[1] but "simply that of election for the discharge of superfluous nervous energy."

Treatment.—This is dietetic, medical and surgical, and obstetric. When the vomiting is not very severe, a trial of various different articles of food may be made, as previously suggested, with the hope that some one of them may be acceptable to the stomach; but if it be severe, it is better, as so strongly urged by Dr. Busey, not to allow the patient to take anything, not even a lump of ice, by the mouth, the stomach being given absolute rest. Rectal alimentation should be the chief trust. The late Dr. Austin Flint has recorded[2] the case of a patient who lived sixteen months solely by this means. Dr. Henry F. Campbell thus successfully[3] treated a lady for the vomiting of pregnancy, continuing the method for fifty-two days; so sanguine is he of its applicability and value that he states "under the careful and systematic application of rectal alimentation, artificial abortion for the relief of gravid nausea can be banished from practice, even as a last resort." Dr. Busey advises enemata of beef-tea, bromide of potassium, tincture of opium, and brandy every four hours during the first twenty-four or forty-eight hours, and afterwards at longer intervals. At the end of forty-eight hours he begins nourishment by the stomach, using milk and lime-water.

Animal broths, peptonized milk, the whites of eggs stirred in water, Leube's pancreatic meat emulsion, and defibrinated blood may also be used for injections into the rectum. Lusk[4] advises that the quantity of a nutritious enema should not exceed four to six ounces, and should not be repeated more frequently than three or four times in the twenty-four hours.

Unfortunately in some of the cases of grave vomiting there is already diarrhœa, and the rectum is intolerant of even so small a quantity as just advised; or again, in other cases after these injections have been successfully used for several days, such rectal intolerance may result that this method of nourishment must be abandoned.

[1] Op. cit. [2] American Practitioner, 1878.
[3] Transactions of the American Gynæcological Society, vol. iii.
[4] The Science and Art of Midwifery.

Blundell suggested "injecting blood into the vessels in case of a high degree of weakness and irritability of the stomach and bowels." He referred, in support of this proposed method, to an experiment he had made upon a dog, into whose jugular vein he injected every day, or every other day, for three weeks, several ounces of blood; the dog was allowed water only, and at the end of the time was in good condition.

Medical and Surgical Treatment.—The chief medical and surgical means have been mentioned. In all cases of persistent and severe vomiting a vaginal examination should be made, and, where possible, means at once used to correct any uterine displacement that may be present. Alkalies, antispasmodics, laxatives, or stimulants may find useful application. By some practitioners more reliance is placed upon opium, or morphine, than upon other agents. Matthews Duncan commends atropia; Talma, of Utrecht, has recently recommended nitro-glycerine, one milligram in the course of the day, given in three doses; Bailly succeeded in relieving an obstinate case of vomiting in pregnancy, by applying to the dorso-lumbar region Chapman's rubber bag filled with ice-water, and a blister to the epigastrium. Quite recently Kohler has cured a case of obstinate hysterical vomiting, by pencilling the fauces with a ten per cent. solution of muriate of cocaine; the same method might be tried with a fair prospect of occasional success in cases of pregnancy vomiting. In the surgical treatment may be included the application of nitrate of silver to the cervix, dilatation of the cervical canal, etc. (See page 217.)

Obstetric Treatment.—As these patients generally recover, provided the exhaustion be not too great, when the womb is emptied, the induction of abortion or of premature labor may be necessary. The proportion of recoveries after one or the other event is given by Gueniot as two-thirds; and among those who die, the death of some is to be attributed to delay in the operation. The induction of premature labor in a case of hyperemesis that persists in spite of the best treatment, and imperils life, need not cause the least hesitation on the part of the practitioner. But the question of abortion is a graver one; it is the certain sacrifice of one life, and, unless absolutely demanded for the saving of the mother's life, is murder. No man should take so serious a responsibility as causing abortion in a case of hyperemesis, unless indorsed in his action by a qualified, conscientious consultant.

The following are among the conditions given by Dubois as justifying the induction of abortion: 1. Almost incessant vomiting, by which all food, sometimes even the smallest quantity of water, is invariably rejected. 2. Emaciation and feebleness, condemning the patient to the most absolute repose. 3. Syncope resulting from slight movements or emotional disturbance. It should be remembered that the cases are exceedingly rare requiring this treatment, some physicians denying that they ever occur; frequently in cases where it appears day after day that this radical method is inevitable, there are almost sudden changes for the better, and the patient soon recovers from her prostrate condition. On the other hand, it would be folly to induce abortion when the patient has passed into the third stage of the disease, not saving the patient's life, but bringing reproach upon medi-

cine: the operation has been deferred too long. Happy is he who is wise enough to avoid this Scylla and that Charybdis.

Relaxation of the Pelvic Joints.—Swelling and softening of the pubic and sacro-iliac joints occur normally in pregnancy; exaggeration of this condition allowing decided motion is a pathological condition. The pubic is more frequently affected than either of the sacro-iliac joints; the disorder usually occurs in the latter half of pregnancy, generally in the last two months, but Moreau has mentioned a case in which the condition began in the second month; in this patient the relaxation continued for more than two years after delivery. Having once occurred, it may recur in successive pregnancies. The late Professor Meigs stated that one of his patients, who had been confined twelve times, generally suffered for several weeks, in the latter part of each pregnancy, from relaxation of the pubic joint. On the other hand, one of my patients who in the latter part of her first pregnancy suffered from relaxation of the pubic and of the left sacro-iliac joints, and for nearly a year after delivery was not able to walk, passed through her second pregnancy without any manifestation of the disorder.

Relaxation of the pelvic joints, first described by Hippocrates, begins gradually; there is a feeling of weakness or weariness, especially after walking; this after a time is followed by pain upon exertion, but, after rest, ceases. The pain may be distinctly referred to the joint affected, especially if that be the pubic, and pressure upon it by the finger shows increased sensibility. The patient will protest against exercise, unwisely advised under these circumstances; she will say it causes severe distress near the hips, that her steps are uncertain, and she feels as if there were something "giving way" in the pelvic bones. When she walks her steps are waddling. Charpentier says it is a balancing from one limb to the other, a sort of oscillation from one side to the other, and describes women as then *marchent en canards.* Barker[1] states that the patient can stand with comparative ease, resting upon one leg or the other, but cannot balance herself upon both legs at once. Abnormal movement in the pubic joint can readily be detected by placing two fingers upon the posterior surface of the joint when the patient is standing, and then having her move the lower limbs alternately; in some cases it may be recognized when the patient is lying in bed. Very frequently there are pain and numbness in the lower limbs. The joint may become very sensitive, so that the slightest movement in bed involving the pelvis is attended with severe suffering, and the unhappy patient is condemned to absolute repose. The relaxation having once begun increases until pregnancy ends. In some cases labor, either natural or artificial, may cause rupture, or, either in pregnancy or in the lying-in, inflammation of the joint may occur. Each of these events, however, is very rare. A guarded prognosis should be given, for while recovery is the rule, it is in some cases very slow, and in few very rapid.

Treatment.—Rest is of the first importance when this affection occurs in pregnancy. I am quite sure one of my patients was injured by per-

[1] Puerperal Diseases.

sistent efforts to walk in the last weeks of pregnancy. A prolonged rest, too, is necessary after labor, and when the patient gets up the joints should be immobilized by a suitable apparatus. Barker states that in all cases he has seen, this immobilization has been effected by a little ingenuity in making and adapting a hip-binder of very strong, coarse cloth. Boyer recommended a girdle of leather. Snelling[1] has suggested sole leather, properly moulded to the shape. Martin's girdle, according to Bailly, has in several instances immediately corrected abnormal mobility of the pelvic joints, and enabled the patient at once to stand and to walk. A plaster-of-Paris bandage would probably be equally efficient and more economical.

Inflammation of the Pelvic Joints.—This has sometimes occurred in pregnancy, but oftener after labor; it may follow relaxation, or occur without it; the inflammation usually affects but a single joint. In very rare cases suppuration occurs; thus, Kiwisch evacuated half a pint of thick pus from the pubic joint. Hilton has narrated a case[2] where inflammation of the sacro-iliac joint followed labor; the inflammation ended in suppuration, but the pus was absorbed. The treatment of inflammation of the pelvic joints need not be detailed, for the means to be employed are obvious.

Rupture of the Pelvic Joints.—This is a rare accident; it usually affects the pubic joint, but may also one or both sacro-iliac joints. It is impossible for it to occur in natural delivery, or in ordinary obstetric operations unless there be an anterior lesion. The treatment is rest and a firm hip bandage.

Hydræmia.—Increase in the water of the blood is a physiological phenomenon of pregnancy; excess in this increase is pathological, and is appropriately called hydræmia. Stoltz[3] describes the condition as a serous cachexia, "a cachexia which does not differ from symptomatic dropsy, for example, that which results from organic disease of the heart, in its course and in its ordinary termination. Instead of being connected with a local organic malady, it is the consequence of a vicious composition of the blood, an exaggerated hydræmia." Cardiac disease may be present, and then the symptoms are manifested earlier.

There may be œdema of the lower limbs only, or it may become general, and there may be, in addition to serous effusion in the connective tissue, effusion also into the great serous cavities, especially in that of the abdomen, constituting ascites. The face is puffed, the limbs greatly swelled, the external genital organs much distended, clear, almost transparent, looking like sacs of water. The patient is incapable of exercise from the greatly swelled condition of the lower limbs, and moreover is readily exhausted by slight exertion; she suffers from palpitation of the heart and difficult breathing. In some cases the fœtus dies, and premature labor or miscarriage occurs. The urine is abundant, and contains no albumen, or only a trace of it; and there-

[1] American Journal of Obstetrics, vol. ii.
[2] Pain and the Therapeutic Influence of Rest.
[3] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome vii.

fore the condition is not to be confounded with the œdema which may occur in renal disease.

In some cases the effusion into the connective tissue is so great that gangrenous patches may be formed upon the lower limbs or upon the external organs of generation.

Treatment.—Tonics, especially iron, rest, occasional derivation to the intestinal canal, diuretics, and the vapor bath are indicated. Œdema of the lower limbs is treated by rest in the recumbent position, or, when sitting up placing the limbs upon a chair; that of the vulva requires frequent cold bathing, possibly in some cases a compress and bandage; in either manifestation of the disease, punctures may be necessary to prevent gangrene. In ascites the effusion may be so great that either it must be removed, or the pregnancy ended; Cohnstein[1] gives very decided preference to the former, and certainly this is the wiser choice. If there be serous effusion into the thorax so that there is great interference with respiration, thoracentesis should be done without hesitation, as this operation is well borne by pregnant women.

Anæmia—Pernicious Anæmia.—In the affection which has just been considered there is that which is designated as anæmia, or a condition which some, especially the late Professor Samuel Jackson, justly have said should be called spanæmia. But there may be such anæmia without the grave manifestations that have been described, for example, the œdema if present is only slight. In addition to the discomforts of the condition, it carries with it future dangers, especially that of post-partum hemorrhage. Hence the importance of improving the character of the blood by proper diet, by correcting any digestive disorder that may be present, and especially by giving an iron tonic; the prophylactic treatment of some cases of hemorrhage after labor ought to begin in pregnancy.

Pernicious anæmia is a much rarer and graver disease. In 1851 Dr. Barclay[2] published the report of a case of anæmia, the disorder occurring in the puerperal state, and proving fatal the fifth month after delivery. Addison in 1855[3] described a grave form of anæmia, which he termed idiopathic. Lebert, in 1853, recorded cases of fatal puerperal chlorosis at Zurich, where subsequent observations were made by Gusserow and Biermer; he regarded them as examples of essential anæmia. Biermer, in 1871,[4] published an account of 15 cases of what he termed progressive pernicious anæmia; and Gusserow five cases of this disease in pregnant women. Coupland[5] collected 110 cases, 54 of the subjects being females, and in twenty of these the starting-point of the pernicious anæmia was pregnancy.

Causes and Symptoms.—Malaria, insufficient or improper food, multiparity, obstinate vomiting, hemorrhage, violent emotion, mental shock, and diarrhœa are among the causes of the disease, as stated in some cases. In other cases no explanation of the occurrence of the

[1] Op. cit.
[2] Medical Times, 1851.
[3] Sydenham Society's edition of Addison's Works, p. 212.
[4] Ziemssen's Cyclopædia, vol. xvi.
[5] Gulstonian Lectures, 1881.

malady could be given. In the majority of cases the disease begins gradually. The face grows more and more pale, and presents a waxy appearance, in some cases it is slightly yellow, but it is not emaciated, the patient retaining, for a time at least, her general plumpness of form, for as Addison remarked, there may be an actual increase in subcutaneous fat. After a time fever occurs, and then there may be some emaciation. The more prominent general symptoms are palpitation of the heart, fainting, headache, generally sleeplessness, but in some drowsiness; hemorrhages are not unusual, there may be epistaxis, or bleeding from swelled and spongy gums, the appearance being that of scorbutus; cerebral hemorrhage has been occasionally observed, and cases of retinal hemorrhage have been frequent. Though Charpentier states the latter are rare, Quincke, quoted by Coupland,[1] found such hemorrhage in all but 7 of 31 cases; Sörensen[2] found it in 10 cases out of 11 examined. The urine is abundant, contains no albumen, or only a trace, has a low specific gravity, and is light colored. Fever, called by Biermer anæmic fever, is a striking characteristic of the disease. The blood is marked by great deficiency in hæmoglobin, and in case this constituent be lessened to about one-fifth the normal quantity, the disease, according to Quinquaud,[3] invariably has a fatal result.

Treatment.—Good food and tonics are of first importance. Transfusion has been tried several times, but has rarely been beneficial; in one case the number of red globules was less forty-eight hours after than it was before the operation. Interruption of pregnancy, proposed by Gusserow, and approved by Charpentier, is condemned by Kleinwächter as hastening the usual fatal termination of the disease.

In the autumn of 1856, and in the succeeding winter and spring, there occurred in Indianapolis and its vicinity several cases of what physicians then termed puerperal anæmia, but which has since been described by Gusserow and others as pernicious anæmia; this conclusion, I think, will be drawn by any one who reads the appended description of the disease, and compares it with that previously given. Dr. Funkhouser,[4] who treated several of these cases, read a paper before a local society, giving a narrative of them. Having myself seen two patients suffering with puerperal anæmia, and having heard the doctor's paper read, I hoped to have at least the leading facts contained in it to present in this work. But unfortunately he failed to find the paper, and in lieu of it sent me the following note:—

Having been requested to furnish you with a paper upon puerperal anæmia, which I read before the Indianapolis Medical Society in 1857, and the paper having been mislaid, I will endeavor to give from memory the chief facts it contained. There were probably in the city about twenty cases in all of the disease, and all, or nearly all, proved fatal during gestation, in labor, or shortly after. It seemed to me that the disease manifested three forms, (1) purely anæmic, (2) scorbutic, and (3) cachectic. In all

[1] Op. cit. [2] Archives Générales de Médecine, tome i. 1880.
[3] Ibid., 1879.
[4] The late Dr. Funkhouser was an esteemed practitioner of Indianapolis for nearly forty years; he graduated at Jefferson Medical College in 1847. He died July, 1886.

there was hemorrhage from some mucous surface, in the scorbutic from the gums. There was total anorexia; the patients suffered from neuralgic pains, they were pallid, exsanguinous, in some cases had a jaundiced hue, and the skin had here and there purplish spots. Generally there was irritability of the stomach, but the most striking feature was an utter aversion to food. Some of the patients had suffered with malarial fever, but in many there was no such history. In many cases premature labor occurred, and it was not uncommon for the fœtus to be dead both in such labor and in labor at term.

I have merely to add to this note that the disease was chronic, having no correspondence in this respect with acute yellow atrophy of the liver, and that I can recall only two cases in which recovery occurred, and in each instance the recovery occupied several months.

Varicose Veins.—The proportion of women, who in pregnancy have varicose veins, as has been mentioned, Budin states to be twenty to thirty per cent., but Cazin[1] makes the number one in twenty-one. The latter proportion, I think, from observations made at the Philadelphia Hospital, nearer correct. Varicose veins are found with almost relatively equal number in primigravidæ and in multigravidæ, though less distinct in the former; in the one they appear from the fourth to the fifth month, but in the others from the second to the third. The internal saphena is in most cases first affected, and in some it only is affected, but the external saphena is frequently secondarily involved. Varicose veins in the majority of cases are found only in the lower limbs, quite as often in the left as in the right; in some cases the disease exists also in the external genital organs, and in some affects them alone.

Among the causes of varicose veins in pregnancy the following have been alleged: Gravitation, compression of intra-abdominal veins by the uterus, increase of blood, change in its character, and increased vascular tension. Cazin refers to the case of a cook, quoted by Chaussier, who always knew herself to be pregnant by the development of varices in her lower limbs, this manifestation occurred in the second month; by compressing them, she readily produced abortion. Cazin suggests from this incident that the enlarged veins act as a diverticulum for the blood plethora, which not thus provided for would affect the womb, and end the pregnancy.

Œdema is liable to occur from varicose veins. It results from the internal pressure of the blood being greater than the external pressure upon the vessels. According to Hardy, pregnancy predisposes to eczema, and this tendency is assisted by the patient's scratching the limb to relieve the itching with which a varicose part is often affected. The scratching may lead to the formation of a varicose ulcer, though this is not frequent, it having been observed but once in forty-seven cases of varicose veins in pregnancy. The treatment of the eczema, usually eczema simplex, and of varicose ulcer, are the same as in the non-pregnant condition.

The most serious complication of varicose veins is rupture. If it be

[1] Archives de Tocologie, 1880–1.

external, an open hemorrhage results, but if internal, and the skin unbroken, the effused blood forms a tumor commonly known as thrombus. A thrombus of the lower limbs is rare, but one of the external genital organs comparatively frequent; the latter may occur before, during, or after labor; the last form is most frequent. Bryant[1] has reported a case where a spontaneous, subcutaneous rupture of the internal saphena occurred in a pregnant woman, with the formation of a thrombus on the inner side of the thigh. Cazin met with a similar case, only the rupture was not spontaneous, but caused by violence. The treatment of thrombus is rest, with cold application to the swelling. The effused blood is usually absorbed, but in occasional instances suppuration occurs. Rupture of a varicose vein with external hemorrhage has occurred from straining at stool, from lifting a heavy weight, standing for a long time, or a prolonged walk, and by a fall or a blow, or from scratching a varicose ulcer. In some cases, however, the rupture has occurred without obvious cause, for example, when the patient was in bed and asleep. If the opening be from a large vessel, and the bleeding be not promptly arrested, death very quickly comes. Several fatal cases have been reported. It should be remembered, in explanation of the rapidly fatal result, that the blood comes not only from the distal, but also from the cardiac side of the opening in the vein. In some cases where there was serious hemorrhage without death resulting, abortion or premature labor followed.

A pregnant woman who has varicose veins ought to avoid all those causes which may lead to rupture, such as being costive, carrying heavy loads, standing long, etc. She should lie down a part of each day, and if the veins are very much enlarged, she may wear a flannel bandage when up. She should further be advised as to the best means for arresting the flow, *i. e.*, immediate and firm pressure upon the bleeding point. The professional attendant called to a case of hemorrhage from the rupture of a varicose vein of one of the lower limbs, will in most cases succeed in permanently stopping the hemorrhage by the application of a compress and bandage. Should this treatment fail, a needle is passed into the skin on one side of, then beneath, the bleeding vessel, and finally through the skin on the other side; a figure-of-8 ligature is firmly applied to the projecting ends of the needle; Cazin suggests a *serre-fine* if the opening be small.

Vogt and Albers[2] have reported cases where the varices of pregnant women have been lessened, and even cured, by the subcutaneous injection of ergotine. More recently, Englisch has met with like success by injecting twenty to thirty drops of equal quantities of alcohol and water; the injection is made in the connective tissue directly beneath the enlarged vessel. But as the varices of gestation are more of an inconvenience than a danger, and as they usually disappear in great degree, if not entirely, after labor, it is not generally advisable to resort to their radical treatment.

Albuminuria.—Authorities differ very widely as to the frequency of albuminuria in pregnancy. Dumas,[3] uniting the statistics of Blot,

1 Medical Times and Gazette, 1850.
2 Quoted by Cazin, op. cit.
3 Quoted by Charpentier.

Hippolytte, Meyer, Abeille, Möricke, and Petit, makes the proportion of pregnant women whose urine contains albumen 1 to 5 or 6. Gillette,[1] 30 per cent.; Van Arsdale and Elliott, 1 in 56; Barker,[2] 4 per cent. "Out[3] of 200 cases in the Guy's Hospital Charity, in which the urine was tested about the time of labor, albumen was found in only four, and two of these appeared to be cases of chronic Bright's disease." In observations at the Philadelphia Hospital, I have not found the urine albuminous in more than six per cent. Galabin suggests a probable reconciliation of the discrepancies by supposing that those who make the proportion so great, used the finer tests by which minute quantities of albumen would be detected.

Albuminuria occurs more frequently in primigravidæ than in multigravidæ; according to Litzmann it is the rule in twin pregnancies; it is more frequent in the late than in the early months of pregnancy; Petit found that in one-fifth of albuminuric mothers the weight of the child was above the average.

Causes.—A woman who is suffering with chronic renal disease may become pregnant, and hence the albuminuria; the disease simply continues. Another may, having become pregnant, be subjected to some of the causes of nephritis, such as exposure to cold, and become albuminuric. But these explanations only answer for a small number of those who have albuminuria in pregnancy. Other hypotheses are necessary. These are, that the renal disorder results from the increased work thrown upon the kidneys by the pregnant state, the greater intra-vascular tension, pressure upon the renal veins by the enlarged uterus, pressure upon the ureters from like cause, and, finally, reflex irritation, this irritation arising from the uterus, and affecting the renal circulation and secretion.

Kormann,[4] in referring to the albuminuria of pregnancy, presents the following views as to its etiology, symptoms, and consequences: "The pressure of the pregnant uterus may affect the ureters and the kidneys. We very frequently find albuminous urine as a consequence of stagnation in the kidney (Rosenstein), and we cannot wonder that a nephritis, seldom acute, results. The latter may have existed before pregnancy, and been exaggerated by it, or an acute exacerbation occurred. Leyden (Zeitschr. f. klin. Med., Bd. II. Heft. I. 1881) divides the affections of the kidney occurring in pregnancy into four classes: the kidney of pregnancy, fatty degeneration and anæmia of the swollen cortex; nephritis from pregnancy, or from puerperality, acute nephritis; pyelonephritis, rare; acute or chronic nephritis, associated with, but independent of, pregnancy. The symptoms of these forms are œdema, which first appears in the lowest portion of the body, thus, when standing in the feet, but in lying in one hand, or in half the body; lessened quantity of urine, albuminuria, headache, and frightful dreams (McLane). Eclampsia very frequently appears in the course of a nephritis, especially in the acute form, and during labor, or at its beginning, which should therefore never be induced prematurely. Disorders of vision and amaurosis occur.

"Halbertsma considers eclampsia of pregnancy due to pressure upon

[1] American Journal of Obstetrics, vol. xi.
[2] Ibid.
[3] Galabin's Manual of Midwifery.
[4] Op. cit.

the ureters. In severe cases violent headache and complete anuria are developed; and, in consequence of the latter serous transudations into various parts of the body and its cavities occur, hydrothorax, anasarca, ascites, hydropericardium, and, finally, uræmia, decomposition of the urea into ammon. carb., or, according to Astaschewsky, excess of potassium salts, or, according to Demjankow, the presence of urea with a ferment, during which abortion or premature labor is liable to occur (Barker), without influence upon the fatal character of the disease, since the uræmic symptoms, convulsions, vomiting, stertor, dilatation of pupils, delirium and coma, indicate the implication of the whole system. In many cases anæmia of the kidney may arise from reflex irritation from the uterus, the kidney of pregnancy. The consequences are anatomical changes in the epithelium of the glomeruli, clinically, evidence of albumen in the urine without a kidney sediment. Anatomical degenerative changes in the epithelium of the urinary tubules appear later; clinically, large quantities of albumen with cylinders and epithelial sediment. In the healthy kidney these changes most frequently occur about the middle, or towards the end of pregnancy. In existing chronic nephritis the vascular disturbances appear sooner, and with greater severity the longer the disease has continued. At the end of pregnancy the renal disorders reach their climax. There is little probability of chronic nephritis developing from the kidney of pregnancy. (Flaischlen, Berlin Zeitschr. f. Geb. und Gynäkol. VIII. 2 S. 354, 1882.) The danger in the kidney of pregnancy consists in retention of urea in consequence of the fatty degeneration of the epithelium of the tubules, and consequent eclampsia. The treatment of mild cases should be expectant; severe ones indicate the induction of premature labor, and in primary chronic nephritis, of abortion. In the kidney of pregnancy there is albumen in the urine; the urine has a high specific gravity, and is lessened in quantity. In chronic nephritis the specific gravity is low, and the quantity is increased."

Symptoms and Course.—Swelling at first of the lower limbs, afterward more general, from serous effusion in the connective-tissue, puffiness and paleness of the face, disorders of digestion,[1] disturbance of vision, neuralgic pains, feebleness, indisposition, and inability to take exercise are symptoms which ought at once to direct the practitioner's attention to the condition of the urine, an examination of which furnishes the final proof of the presence of the malady. "Such examination of the urine of the pregnant woman, especially if a primigravida, ought, as has been previously enjoined, to be made in the last months of pregnancy, and this examination repeated from time to time." Another reason for repeating the examinations of the urine is that the quantity of albumen is quite variable, not only from one day to another, but from morning to evening. The albumen may entirely disappear for a time, and then reappear in much greater quantity.

In many cases, probably in most, if albumen is found in notable amount in the urine of a pregnant woman, it does not permanently disappear until after labor; then its final absence occurs in most within a short time, in others albumen may still be found months after

[1] Dr. W. L. Richardson, of Boston, has especially directed attention to the importance of nausea and vomiting returning in the latter months of pregnancy, as a symptom of nephritis. American Journal of Obstetrics, 1879.

delivery; thus in one of my patients, who had premature labor with twins, there was still some albumen in the urine at the end of six months, after which it ceased to be present.

Persistent and notable albuminuria is a menace of abortion, of eclampsia, of premature labor, and of post-partum hemorrhage. It is true in regard to eclampsia, as the gravest of these, because it especially imperils the life of the mother, that by far the smaller number of albuminurics, only four or five out of twenty, are eclamptics, yet very rarely does eclampsia occur in a woman who has not albuminuria.

Treatment.—If the quantity of albumen be small, and there be no general disorder, no indications of blood-impoverishment and no œdema, there is no indication for active treatment, but for constant watchfulness lest the condition of the urine be the forerunner of serious disease, and for dietetic means. If the urine is highly albuminous, and œdema is present, active treatment should at once begin. A saline cathartic may be given every other day, and the intervening day a vapor bath, or a hot bath employed. In regard to the latter, which in many cases proves very efficient in relieving the œdema, and other manifestations of the condition, it should be taken at a temperature of 98° to 100°, the patient remaining in the water about fifteen minutes; then upon coming out she should be quickly and thoroughly dried, and covered with warm clothing, and drink a tumbler of hot water or of hot milk. Generally within a few minutes a profuse perspiration occurs, and continues from one half to an hour. The administration of diuretics, especially of the acetate of potash, is advocated by some. Iron, particularly the muriated tincture as recommended by Barker, and other tonics, are to be given to improve the condition of the blood. But the most important treatment, according to many, is a diet of milk, as advised by Tarnier. He directs the first day one liter, a little more than a quart of milk, and two meals the first day; the second day, two liters of milk, and one meal; the third day, three liters, and half a meal; the fourth day, four liters of milk, or as much milk as can be taken, but no other food, no other drink, and thus through the succeeding days. If the case be a grave one, and eclampsia be threatened, the absolute milk diet should be begun at once.

Satisfactory results often, not always, follow the milk regimen. Moreover many patients soon weary of it; they grow weak, milk disgusts them, and it is with the greatest difficulty they can be persuaded to continue the treatment; at least they are unable to take the quantity of milk advised by Tarnier.[1] While not going as far as Pajot, who says that the milk regimen has never prevented eclampsia except in a woman who would not have the disease, it must be confessed that it is not by any means successful in all cases.

Routh has mentioned[2] a case of eclampsia in a woman during labor,

[1] Galabin, op. cit., in referring to the diet in albuminuria, says: "Great advantage has been found from a diet which gives the kidneys as little work as possible in excreting nitrogenous material. The indication is best fulfilled by a diet consisting of milk and starchy material, such as corn flour, sago, arrow root, etc., alone. In chronic cases a little meat and bread may be given, but beef-tea and meat extracts should be avoided." This treatment may be tried in cases where it is impossible to continue a diet exclusively of milk.

[2] London Obstetrical Society's Transactions, vol. xxiv.

and after using chloroform without benefit, prolapse of the cord led him to place her in the knee-chest position, when the convulsions ceased, and did not return. This success suggests that it would be well to try the same position in treating the albuminuria of pregnancy, letting the patient assume it several times a day; and she should as much as possible avoid lying upon her back. Of course the end accomplished by the position is relief of renal congestion arising from pressure of the gravid uterus.

Most authorities reject abortion, or the induction of premature labor in the treatment of albuminuria. Never induce labor, and especially never abortion, for it is a practice more dangerous than eclampsia itself, is the teaching of Pajot. This probably is going too far, and the advice on page 247, in referring to the "kidney of pregnancy," may be better.

A fatal case of eclampsia at the seventh month of pregnancy occurred in my practice, which leads me to believe that in some cases of albuminuria abortion is justifiable. The patient had been pregnant three times previously; in these, as well as in the fourth, albumen appeared in the urine very early, and in the first three spontaneous abortion occurred, but in the fourth the patient, by the use of the milk diet, hot baths, and occasional diuretics, got on quite well for a time; occasionally the urine was almost free from albumen; but at seven months acute renal failure occurred, and convulsions that proved fatal within sixteen hours, in spite of bleeding, chloroform and chloral, and assisting labor—which came on early in the convulsions—by artificial dilatation of the os and delivery with the forceps. Spontaneous, or artificial, abortion would almost certainly have saved this patient.

In regard to the induction of premature labor, Thomas[1] takes the position that in cases where the urine, treated by nitric acid and heat, is almost completely coagulated—where there is excessive anasarca, the stomach, brain, and nervous system sympathize, and tendency to coma is denoted by constant desire to sleep—the condition calls for premature delivery. Barker[2] believes that resort to this operation should be limited to those cases where treatment has been thoroughly and perseveringly tried, without success, for the removal of symptoms of so grave a character, and there is a strong possibility that their continuance would result in the death of the patient.

[1] New York Medical Journal, 1870. [2] American Journal of Obstetrics, vol. xi.

CHAPTER IX.

ECLAMPSIA.

Eclampsia—Puerperal Eclampsia—Puerperal Convulsions.—Eclampsia is an acute disease occurring in women in pregnancy, in labor, or in childbed, often sudden in its onset, rapid in its progress, characterized by convulsions, with loss of sensation and of consciousness, ending in coma. (Bailly.) The sudden onset is indicated by the word eclampsia, from εκλαμπω, to shine out, to flash.

The intimate connection in most cases between this disease and albuminuria suggests that its consideration should immediately follow that of the latter. It belongs to the pathology of pregnancy rather than to that of labor, for though, according to most authorities, it is more frequent in the latter than in the former, it is more serious if it occurs in pregnancy. Possibly, too, as held by Bailly,[1] it is really more frequent in pregnancy, for as labor generally results from eclampsia, many of the cases of the disease may have been reported as occurring in labor, and "statistics often fail in giving information as to whether labor had actually begun before the first convulsion." The disease is most frequent in the last months of pregnancy, though it has been observed as early as the first month. Considering the disease as it may occur in pregnancy, in labor, or in childbed, its frequency, according to Kleinwächter[2] and Galabin,[3] is one in 500; Kormann makes the proportion one in 600, while Cazeaux stated it one in 200. Lusk[4] found one fatal case in about 700 deliveries; now it is not unreasonable to suppose that there were at least two cases that recovered from eclampsia to one that died. Again, in the five years, from 1880 to 1884 inclusive, there were, by the statistics of the Philadelphia Board of Health, 94 cases of eclampsia to 100,935 deliveries, or nearly 1 in about 1000. Supposing, again, that there were at least two cases that recovered to one that died, the number of cases of eclampsia would be 1 to 333⅓. Corson[5] met with 10 in 3036 cases of labor, that is, about 1 in 300. It is probable, therefore, that in this country at least the proportion is 1 to 250 or 300. Eclampsia is less frequent in childbed than in pregnancy or in labor. The attack usually occurs a few hours after delivery, but the interval may be several days,

[1] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xii.
[2] Op. cit. [3] Op. cit.
[4] "The total number of deaths from this cause reported to the Board of Health in New York City, in the nine years from 1867 to 1875 inclusive, were 408. The estimated maximum number of deliveries during that period was 284,000, or nearly 1 death to 700 confinements." The Science and Art of Midwifery.
[5] New York Medical Journal, May, 1886.

or even some weeks. Bailly saw a case twenty-nine days, Simpson four weeks, after labor. The disease is more frequent in primiparæ than in multiparæ, and in multiple than in single pregnancies.

Premonitory Symptoms.—These occur in almost all cases. The most important are headache, disturbance of vision, and epigastric pain. The first is generally in the forehead, and in some upon one or upon the other side of the forehead; it is rarely in the occiput. Hamilton referred to frontal pain as especially characteristic. At first it is not continuous, but has irregular intermissions, or at least remissions; when it becomes constant the attack is at hand. It is the most frequently manifested premonitory symptom. It is not unusual, if this pain occur several days before the convulsive manifestations, for slight mental disorder to be associated with it, generally simply dulness of intellect, or apathy; the patient, too, may be either sleepless or drowsy. Disturbance of vision is in very many cases observed. This at first is usually indistinctness of sight, or inability to use the eyes for more than a few minutes at a time; the letters on the page which the patient is reading are blurred, or she cannot take the stitches in the work she is sewing in the right place; she wearies in the effort, and lays aside one or the other object. In rare cases more or less complete blindness may be present for hours, or even for days before the attack; in other instances amblyopia, hemiopia, or diplopia, are manifested. Epigastric pain is the least frequent of the prodromata. If present it may be so severe that the patient groans, or even cries out with the suffering; she leans forward to relax the abdominal muscles, and usually has, with the pain, oppression or difficulty in breathing. Other premonitory symptoms have been observed in some cases, such as vertigo, vomiting, somnolence, or insomnia, ringing in the ears, irritability of temper, and despondency.

The Attack.—After a longer or shorter duration of some of the prodromata—their apparent absence in any case probably being from a failure of observation—the convulsive manifestations come abruptly. The patient lying in bed may have been talking to you one minute, the next she is silent, and you see her face in complete repose, her eyes fixed apparently upon some distant object, and her body motionless; this is the brief calm which precedes the terrible storm. While you are looking, and possibly, if it is your first experience, wondering why her speech has so suddenly ceased, the storm begins with quick movements of the eyelids and of the nasal alæ, then of all the muscles of the face. The eyelids rapidly open and close, the pupils are dilated and insensible to light, the eyeballs move in various directions, then are half hidden beneath the upper lids, the face turns slowly towards one and then to the other shoulder, the mouth is distorted, usually "deviated to the left." The wave of convulsion extends to the muscles of the trunk and limbs, and a stage of tonic contraction occurs; the body is rigid and the back is arched as from opisthotonos; the lower and upper limbs are rigid and usually extended; the thumb is flexed upon the palm, and the fingers contracted over it. Bailly mentions a case in which at the beginning of numerous convulsive attacks the unhappy patient invariably raised the left arm over

her face, almost in the position taken to ward off a threatened blow. The diaphragm and thoracic muscles are involved, and respiration is arrested; the livid pallor of the face is succeeded by a dusky red hue; the face is swelled and indicates asphyxia; the muscles at the base of the tongue cause this organ to protrude from the half-open mouth, and it is in many cases more or less severely bitten, and then blood mixed with saliva escapes from the mouth. The muscles of the larynx by their contraction prevent the ready escape of air from the compressed chest, and it passes out with a hissing sound. In ten to twenty seconds clonic succeed the tonic convulsions; these begin in the face, then affect the muscles of the body and limbs; the jaws open and close violently and rapidly, the tongue may be again wounded; breathing is stertorous, irregular, and difficult; at each expiration frothy saliva flecked with blood may be thrown in spray over the clothing of the upper part of the body; jerking movements of the muscles of the body and limbs occur rapidly. The sudden transition from calm to storm is not more striking than the rapid transformation of the face and expression; the convulsions destroy every trace of beauty and intelligence that may have been present a few minutes before; the face is disfigured by "horrible grimaces," distorted, discolored, and while calling for pitiful and active sympathy, may be even hideous or repulsive.

While in most cases the general position of the body does not change during the clonic convulsions, in some there are irregular general movements by which it may be thrown from one to the other side of the bed. Whether the muscles of organic life are affected by convulsive movements or not, is a question in regard to which difference of opinion exists; if they are, the explanation of the passage of the feces or of urine, occurring in some cases, is obvious; but if they are not, such evacuations are to be attributed to the convulsive action of the diaphragm and of the abdominal muscles. Braxton Hicks[1] states that in one case of eclampsia, occurring in the sixth month of pregnancy, "when an attack of convulsions came on, the uterus became intensely firm, and so remained for the space of ten to fifteen minutes without any change, after which it slowly subsided into the ordinary condition of gentle contraction with relaxation." Similar phenomena were observed by him in another case. "Cutaneous and visceral congestions, caused by the suspension and disorder of respiration, increase during the first period. They are manifested at the periphery by the injection of the eyes, and the sub-conjunctival ecchymosis, by the color and the heat of the skin, and finally by an abundant perspiration, which bathes the entire body." There is not an abrupt arrest of the disordered movements of the clonic stage of eclampsia, but they first lessen in violence and frequency, then cease. Their duration is generally from one to two minutes, but it may be five minutes, and Tarnier once found it twenty minutes. According to Cazeaux, the pulse is full and strong at the beginning of the attack, but this is

[1] Transactions of the London Obstetrical Society, vol. xxv.

probably not the rule; in either case it becomes weak, small, and almost imperceptible with the progress of the convulsive phenomena.

During the attack the patient is insensible to the most powerful external excitants; she can neither see, nor hear, nor feel. Coma or stupor follows the clonic convulsions, the duration of the coma being proportional to the severity of the attack. In most cases within half an hour after the convulsive movements have ceased, the patient wakens, at first into a sort of semi-consciousness; she looks upon those surrounding her bed, and does not at once recognize them; when the recognition comes, she does not understand the anxiety which their countenances so often express; her face has a sadly bewildered expression, the past, so far as the convulsions are concerned, is a perpetual blank, and the present a temporary cloud. In rare cases the patient's recovery immediately begins, and is rapid and perfect. But in the majority eclampsia is not limited to a single attack; other attacks generally follow, the intervals varying from a few minutes to several hours; the attacks may be so rapid, the intervals so brief, that the patient passes directly from coma to convulsion without a moment of even partial consciousness intervening. The coma becomes more profound with the successive attacks. It is caused by cerebral congestion; the congestion results from the arrest of respiration, and from the impeded return of blood from the brain arising from compression of the jugulars by convulsed muscles of the neck; in addition to cerebral congestion, there may be serous effusion. The number of attacks may be only two or three, or there may be but one, or there may be one hundred[1] and even more. Charpentier refers to a case observed by Crettet, in which there were one hundred and sixty.

The urine, which is usually scanty, in almost all cases contains albumen; in some cases it is smoke-colored, or red, from the presence of blood. The pulse varies in frequency from 100 to 140; even this last number may be exceeded. The temperature[2] progressively increases during the continuance of the attacks; it may reach 104° F., or go even much higher.

Termination—Maternal and Fœtal Mortality.—Eclampsia usually terminates within forty-eight hours, and the great majority of patients recover. When the attacks are not frequent and severe, when there is partial recovery of consciousness in the intervals, the quantity of albumen in the urine not great, and the temperature, though it may have reached 104° or even 105°, steadily falls, the prognosis is favorable. On the other hand, the prognosis is graver the earlier in pregnancy or in labor the attack occurs, and the longer the uterus is not emptied, delivery not effected; it is graver the more frequent and severe the

[1] Pajot and Bailly have each had a patient in whom more than one hundred convulsive attacks occurred, yet both patients recovered.

[2] Jean Robin (Paris Thesis, 1883) remarks, in referring to the temperature in the diagnosis of eclampsia: "M. Bourneville has shown that the temperature is progressively elevated in eclampsia and attains even after death the great degree of 109° F." This would be a valuable sign as an element of diagnosis if met with in all cases, for nothing similar occurs in uræmia, where, on the contrary, the temperature is lowered. Unfortunately in a quite recent observation, it completely failed. We see in fact that the temperature did not pass 99.5° F. (Thesis of Caix, Paris.)

attacks, and the more profound and prolonged the intervening coma, the scantier the urine and the greater the quantity of albumen it contains, and the higher the temperature. In regard to the number of attacks with reference to prognosis, Charpentier's statistics state that if this be from one to ten, one-fourth of the patients die; sixteen to twenty, one-third die; twenty-one to fifty, one-half die. Eclampsia before, is more grave than if it occur after, delivery or in labor. The prognosis is more serious if the patient be suffering from cardiac or pulmonary disease. Death may occur from asphyxia, during a prolonged tonic convulsion, but this is rare; the majority of patients die during coma by a "slow asphyxia." Others die from congestion or cerebral hemorrhage. The eclamptic is more liable to post-partum hemorrhage and to puerperal accidents, and a number surviving the convulsions may perish in the puerperal state. "In the Guy's Charity, the mortality was 50 per cent. in cases which began before the onset of labor, 25 per cent. in those which began during labor, and only 8 per cent. in those which began after delivery, the total mortality being 25 per cent." (Galabin.) In general the maternal mortality is 30 per cent. In the majority of those who do not die, recovery is complete, but in others some disorder of intellect or of sense may continue for a greater or less length of time; the eclampsia may end in puerperal mania or puerperal paralysis. The fœtal mortality is about 50 per cent. The death of the fœtus is to be attributed to asphyxia, to apoplectic effusions in the brain or in the spinal cord, and to the high temperature caused by eclampsia.

Pathological Anatomy.—In the majority of women dying from eclampsia, the examination of the encephalon shows some vascular change, hyperæmia, anæmia, serous effusion, or extravasations of blood in the brain or its membranes. The lungs are generally found congested, and there may be apoplectic effusion and emphysema; there always is œdema. The kidneys usually show the presence of tubal, or of parenchymatous nephritis.

Influence of Eclampsia upon Pregnancy and upon Labor.—The continuance of pregnancy in an eclamptic is quite exceptional, abortion or premature labor usually resulting from the disease. Even in cases where neither occurs immediately, the fœtus usually dies, though it may not be expelled until several days afterward. The progress of the labor is usually quickened, not because of any increased force of uterine contractions occurring during the convulsive phenomena, but because of the lessened resistance which accompanies the general relaxation occurring in the intervals between the attacks.

Etiology.—Various theories of puerperal eclampsia have been proposed, but it must be confessed no one is satisfactory.

1. *The disease is caused by cerebro-spinal congestion.* This theory was generally held by the older British and American obstetricians, though by many it was not adopted to the exclusion of other theories. Dr. Dewees taught that puerperal convulsions were epileptic, apoplectic, or hysterical. He considered "a strong determination of blood to the head" as a premonitory symptom, and at once bled, purged, and put the patient on a low diet. Dr. Meigs asserted that

the disease was caused by long-continued or violent determination of blood to the head, by the rapid revolution of the blood excited by pregnancy or labor, or by too intense perception of the pains of labor. Dr. Hodge held that "convulsions in a large proportion of cases arise from a congestion of the bloodvessels of the brain, or from an actual effusion of serum or blood into its substance or cavities." Without referring to any more authorities, it is now generally maintained that cerebral congestion is not the cause, but the consequence of the eclampsia.

2. *General or cerebral anæmia* is by some held to be the cause. According to this theory, known as the Traube-Rosenstein theory, the eclamptic patient being hydræmic, increase of arterial pressure causes serous effusion, and this effusion compressing the cerebral vessels, acute anæmia of the brain results. Convulsions are the consequence of anæmia of the bulb, and coma of anæmia of the encephalon. Hecker[1] has thus answered this theory:—

First.—The hydræmia, which is a necessary condition for the theory, is so common in pregnancy, eclampsia ought to be of much more frequent occurrence if this had an important influence.

Second.—The increased arterial pressure may occur in labor, but is not found in pregnancy and in puerperality.

Third.—The anæmia and œdema of the brain are more naturally explained, it seems to me, as secondary to the attacks, than regarded as primary and the cause of the convulsions. It is frequently observed, and this sustains my view, that consciousness, a correlate of an intact brain, is lost to a greater degree—the loss is more and more pronounced—the more frequently the convulsive attacks occur, and it always seems to me that post-mortem examinations show marked results in this direction when death has followed a number of attacks.

3. *Congestion and Anæmia.*—The late Dr. Angus MacDonald, finding in post-mortem examinations, congestion in the meninges and engorgement of the venous sinuses on the inner aspect of the cranium and spinal canal, and intense anæmia of the deeper portions of the brain, and especially of the collective motor centres, including the cord, held that there was a toxic substance in the blood which caused this anæmia. This theory, so far as the convulsions resulting from anæmia thus produced, has remained without supporters.

4. *Eclampsia is a neurosis.* Tyler Smith, who was the most eminent supporter of this theory, remarked: "In conclusion, to give a summary of the whole subject, the true puerperal convulsion can only occur when the central organ of this system, the spinal marrow, has been acted upon by an excited condition of an important class of incident nerves, namely, those passing from the uterine organs to the spinal centre, such excitement depending on pregnancy, labor, or the puerperal state. While the spinal marrow remains under the influence of either of these stimuli, convulsions may arise from two series of causes —those acting primarily on the spinal marrow, or centric causes; and, secondly, those affecting the extremities of its incident nerves—causes of eccentric or peripheral origin." The answers to this theory are,

[1] Beobachtungen und Untersuchungen aus der Gebaranstadt zu München. Munich, 1881.

first, eclampsia may occur either before or after labor when the uterus is in complete repose, not the slightest manifestation of an irritated condition; and second, the uterine irritation being so much greater in primigravidæ, they ought to be much more generally the subjects of eclampsia. It is now generally held that while uterine irritation may, in some cases, assist in causing a convulsive attack, it is not the chief cause of the disease; or even if in a very few cases it may be the chief or the only cause that can be discovered, it is inadequate to explain the majority of cases.

5. *Eclampsia results from a poisoning of the blood by which it is rendered unfit to act normally upon nerve centres.* This view is that which is most generally accepted, and the origin of the poison is also generally regarded as arising from failure of the kidneys. As recently stated by Dr. Tyson,[1] "the majority of cases of puerperal convulsions, associated with albuminuria, are due to acute nephritis." Elsewhere this eminent pathologist has said: "Bright's disease, which I believe to underlie the large majority of serious cases of puerperal convulsions, may either be present at the time the woman becomes pregnant, have preceded the pregnancy, or it may be acquired during the pregnancy."[2] In the great majority of the eclamptic the urine contains a large amount of albumen. But, admitting that renal disease, as shown by chemical and miscroscopic examination of the urine, is the fact in almost all cases of puerperal eclampsia, what is the poison which is present in the blood, and causes the convulsive phenomena? Different answers have been made to this question, and some of these will be mentioned.

a. The poison is urea, and hence the convulsions have been called uræmic, a name still retained, though expressing an error. There is an excess of urea in the blood of the eclamptic, but eclampsia does not occur in the cholera patient whose blood is loaded with this element. Moreover, direct experiment upon animals, made by Bernard, injecting urea into their blood, failed to produce the phenomena of puerperal convulsions. The temperature, too, of the eclamptic is different from that of the uræmic; in the latter it descends below the normal, while in the former the reverse is observed.

b. The uræmic theory having been overthrown, it was suggested by Frerichs that carbonate of ammonia was the toxic agent. The convulsions, therefore, if this theory be true, should be called ammoniemic. But this theory, too, has been disproved.

c. The poison is not a single element, but the various extractive matters, creatin, creatinin, etc., which are retained with urea in the blood. Hence the name proposed for the convulsions is urinæmic. "The pregnant woman attacked with eclampsia is urinæmic. It is because there is an accumulation of all of the elements of urine in the blood, that she is attacked by the final accidents known under the name of eclampsia."[3] But the urinæmic theory is open to the same objection as that alleged against the uræmic. In case of urinary reten-

[1] Medical News, May 1, 1886.
[2] Peter.
[3] The Causal Lesions of Puerperal Convulsions.

tion, or renal failure in man, or in the non-pregnant woman, the temperature changes are not those occurring in eclampsia.

Hyppolitte's results[1] from the study of thirty cases of eclampsia, with reference to temperature, are as follows:—

1. In the great majority of cases of eclampsia the temperature rises from the beginning of the attack to the end; it may, however, though this is very rare, remain stationary, or become lower, notwithstanding the attack. The temperature most frequently ascends to its maximum during the tonic convulsion, then slightly lessens, .36 to .54, during the clonic convulsions.

2. In the interval between the attacks, the temperature remains high, and at the moment of the convulsions there is a slight ascent of the mercury. Still, in some cases, after several attacks, a normal or a subnormal temperature may be met, 96.08° F., but the temperature does not remain at this level; with the attacks, or in some of the intervals which separate them, as a rule it rises.

3. If a fatal result is to occur the temperature continues to rise, and attains a very high degree. But if recovery is to take place, the coma lessens, and finally disappears, and the temperature gradually declines until it is normal: it may also happen that the temperature becomes lower before the cessation of the attacks. During their progress the temperature is most frequently between 101.84° F. and 104° F. It is quite exceptional for an eclamptic whose temperature reaches 105.8° F. to recover.[2]

The most recent suggestion as to the toxic agent in the blood of the eclamptic, is that[3] made by Doléris and Butte. They have found soluble toxic ptomäines in the blood of the eclamptic, which they believe may be the cause of the disease in at least some cases. They claim that this discovery permits putting aside the exclusive idea of renal insufficiency from congestion, spasm, compression, old lesions of the kidneys, etc., and the purely nervous theory; still more, that as clinical observation has taught eclamptic, like epileptic, attacks do not have a single etiology.

Returning to the generally accepted view that eclampsia is dependent upon nephritis, it has been objected that a comparatively small number of albuminurics are eclamptics. The answer given to this objection is, the fact that in chronic nephritis there may remain enough healthy renal structure for the process of elimination; it is only when a fresh inflammation occurs that renal insufficiency is evident, and eclampsia follows. Another objection is, that in some cases of eclampsia post mortem examination shows very slight change in the kidneys, or none at all. Spiegelberg answered this objection by stating that sudden renal insufficiency may be developed in hitherto healthy individuals, the urinary suppression resulting from a rapidly occurring affection of the bloodvessels of the kidney, which condi-

[1] See Charpentier.

[2] In regard to this statement it may be said that in one of the seven cases successfully treated by Pinard, which will be referred to hereafter, the temperature was 105.8° F.

[3] Nouvelles Archives d'Obstétrique et de Gynécologie, May 25, 1886.

tion would not leave any important pathological changes. He further suggested that this change might be a degeneration of their walls, or a spasm of the vessels arresting the blood supply. A third objection has been made, that eclampsia may occur in those who are not albuminurics. Charpentier has collected 141 cases of puerperal convulsions without albuminuria. According to Spiegelberg such cases do not belong to the domain of eclampsia, and he thought it best to call them eclamptiform.

The last statement, it will be seen, implies the acceptance of Tyler Smith's view as to the reflex origin of eclampsia, but, of course, it is applicable to only a few cases. Tyson remarks:[1] "There are no reasons why we should exclude from the causes of convulsions in the puerperal state those which operate to produce convulsions in the non-puerperal condition." He holds, therefore, that irritation, as the pressure of a child's head upon a rigid os, may produce convulsions. Convulsions may occur, too, after delivery, for the effect may still remain, or the response to the irritation may be delayed. Further, he regards it as not impossible that convulsions may be caused by cerebral congestion, resulting from severe voluntary efforts in labor.

Roberts,[2] in considering the subject, states: "At least three categories seem to deserve to be recognized, viz: 1. Cases depending upon confirmed and chronic Bright's disease. In these the eclampsia must be regarded as mainly or wholly uræmic; the ultimate prognosis is lethal, and depletive measures are less indicated than chloroform, etc. 2. Cases depending upon passive congestion of the kidneys, or on a condition resembling, if not identical with, acute Bright's disease. These are usually primiparæ; the phenomena are partly, probably, uræmic and partly reflex; the prognosis is favorable, were the fits over; active depletive measures are indicated. 3. Cases depending on reflected uterine irritation and meningeal congestion. In these the urine is not albuminous; the prognosis is favorable were the fits over; they call for active depletory treatment."

But cases belonging to the third class, as stated above by Roberts, are very rare, and they do not present the gravity of albuminuric eclampsia; the convulsive attacks are less frequent and severe.

Diagnosis.—Premonitory symptoms usually herald the disease; in the majority of cases of eclampsia the physician can, if in previous attendance, give a probable prediction as to its coming. Hysterical convulsions will mislead only a careless observer, for the past history of the subject is different; the convulsive phenomena in eclampsia pursue a regular succession, there is order in disorder, but in hysteria they are irregular, there seems almost a capriciousness in the movements, they may be grotesque, sometimes ludicrous, and the face presents a striking contrast with that of the eclamptic, horribly distorted by the rapid movements of clonic convulsions; in eclampsia the convulsive movements end in coma; in hysteria they may cease with tears or laughter, or with a profuse secretion of urine. A cry

[1] The Causal Lesions of Puerperal Convulsions.
[2] Urinary and Renal Diseases.

heralds the onset of an epileptic attack; the history of the patient tells of previous attacks; the urine does not contain albumen; the coma is brief. If coma result from apoplexy there will be accompanying paralysis, and the urine does not contain albumen.

Treatment.—This is naturally divided into prophylactic, curative, and obstetric. So far as prophylactic treatment is concerned, there is little to be added to that advised in the treatment of albuminuria. But the danger being immediate, so much the more reason for prompt and active means. There are cases in which the symptoms are so urgent that it is impossible to wait the action of hot baths, of cathartics, diaphoretics, still less of dietetic means. In such cases, benefit from moderate bleeding is prompt. After this, should it be thought necessary, the treatment previously advised may be followed.

Curative Treatment.—During the attack the obstetrician should see that the clothing of the patient is loose, should forbid efforts, so often unwisely made with the vain hope of restraining her movements, but at the same time care should be taken to prevent the possible accident of her falling from the bed; injury of the tongue must be guarded against, not by interposing cork, or rubber, or a spoon, or piece of wood between the jaws, but by stretching a soft napkin between them, from one side to the other of the mouth, so as to keep the tongue from protruding. As soon as possible an active cathartic, such as compound powder of jalap, should be administered—some prefer elaterium—and in case the patient cannot swallow, a drop or two of croton oil may be placed upon the tongue; a stimulating enema should also be given.

Bleeding was formerly regarded by most authorities as the essential treatment of eclampsia, but in recent years general professional opinion is much less in favor of this means than formerly. The American school of obstetricians have strongly advocated blood-letting. For example, the late Dr. Dewees held that the quantity of blood must be enough to abate the severity, or arrest the repetition of the fits, it might be effected by thirty or forty ounces suddenly drawn, or it may require upwards of a hundred in a few hours. The late Professor Meigs taught that if there be a case of disease in which bold and daring employment of the lancet is demanded, it is the puerperal convulsion; the patient ought to lose from thirty to sixty ounces at one venesection.

Eminent French authorities have expressed differences of opinion upon the subject. Trousseau[1] said that he did "not include in the treatment of eclampsia general or local bleeding, no more than I advise them in epilepsy or in the eclampsia of children." Depaul advocated copious bleeding, 1500 to 2000 grams in a few hours. Pajot, referring to copious and repeated bleeding, states that he has seen this method employed so many times unsuccessfully, he does not advise it; but he thinks it would be a mistake to entirely banish bleeding from the treatment of eclampsia; in robust and plethoric women it succeeds.

Among German authorities, Spiegelberg was a warm advocate for bleeding. He remarked: "From my experience, which corresponds with

[1] Clinical Medicine, volume i.

that of the older authors and most practitioners, I place blood-letting first in the treatment of eclampsia. It is sustained, too, on theoretical grounds; no means so quickly lessens the arterial pressure, none so quickly restores their function to the kidneys irritable from this blood-pressure, and few act so readily upon the excited vaso-motor nerves, causing relaxation. As soon as possible after the first attack take from the arm at least 200 grams of blood; in very robust persons I have not hesitated to take 500 grams, and I never regretted it. If the first bleeding do no good, it may be repeated after an interval determined by the condition of the patient."

The author of the most recent English text-book upon obstetrics, takes the position that venesection should be generally reserved for a last resort in cases in which all other means fail to arrest the convulsions, or in which it is thought extreme venous congestion of the lungs would be relieved by a slight depletion. It must be recognized that eclampsia has different causes, and occurs in subjects in very different general physical condition, and bleeding ought not to be regarded as universally applicable. Nevertheless, in this day when the reaction against venesection is so strong, there is more danger from its being omitted in cases of eclampsia in which it is needed than there is of its being injuriously or unnecessarily used. In addition to the argument used by Spiegelberg, the abstraction of blood gains time for the use of other therapeutic means, and prevents the consequences of congestion; the abstraction of ten or fifteen ounces of blood can only, in exceptional cases, be immediately or remotely injurious. Dr. Barker's advice is, "When the attack occurs before labor, if the pulse be strong and hard, with great fulness of the vascular system, and the appearance of the face indicates cerebral congestion, bleed at once;" but taking away so much blood as to depress the vital powers is forbidden. So, too, if the attack occurs during labor, bleed if there be venous turgescence of the face and neck, a flushed face, a hot skin, and a strong, full, and bounding pulse.

But bleeding cannot remove all the poison, only a small part of it, that is supposed to be circulating in the blood; it removes consequences, prevents symptoms, and facilitates the action of the kidneys. Profuse bleeding is not best, for the statistics of Charpentier prove that recovery is less frequent after copious than after moderate depletion. At the first threatening of another paroxysm chloroform inhalation should be at once begun, and continued until the convulsive attack ends; even then it is best to continue the inhalation, though using only a small quantity of chloroform, for some hours, but the quantity must be increased at the approach of a convulsive paroxysm. The anæsthetic, of course, has no influence upon the irritant poison, but it lessens or removes the sensitive motor power of the spinal cord and the bulb.

Next in value to chloroform inhalation is chloral by rectal injection. Chloral lessens arterial pressure and reflex excitability, and lowers the temperature; these are indications clearly presented by eclampsia, and hence the value of this agent. It should be administered in a dose of thirty or forty grains, or even more; it may be used with the yelk of an egg and six ounces of milk, or in a mucilaginous mixture, and injected

into the rectum. Charpentier pursues the following plan in using this agent: Four grams in 100 grams of quince mucilage are injected into the rectum, and if the injection is not retained, it is repeated a second or third time until the rectum is tolerant. In five or six hours the injection may be repeated; in one case twelve grams were given in ten, and in another sixteen grams, in twenty-four hours. The intervals between the injections are increased as the convulsive attacks become less frequent and milder, but the remedy is not to be abruptly withdrawn. Plant[1] has reported a case of eclampsia occurring after delivery, in which he gave within twenty-four hours 250 grains, about 15 grams, of chloral. In some cases even 20 grams, or more than 300 grains, have been given within twenty-four hours. Of eight cases treated by Pinard[2] at the Hôpital Lariboisière, in 1883, by chloral, only one died. The quantity of chloral administered in a single rectal injection was six to eight grams.

Morphia hypodermatically is very favorably regarded by many. Spiegelberg advised either chloral or morphia, but seemed to give his preference to the latter. Clark, of Oswego,[3] has been a warm advocate of the treatment of eclampsia by morphia. He directs that the patient should at once have injected into the arm a grain and a half. "Should the paroxysm return any time after two hours this dose should be repeated. And, if she be in labor, she should have another dose after eight hours any way." Smith,[4] of Melbourne, is quite as ardent in his praises of this remedy as is Clark, though he does not use such heroic doses; he states that no case of eclampsia has died in the Melbourne Hospital since employing the morphia treatment. He gives hypodermatically one-fourth to one-third of a grain—it should not be combined with atropia; the injection, but with a smaller quantity of morphia, is repeated in a few hours if the patient has another fit. Pilocarpine, nitro-glycerine, and nitrite of amyl are among the new drugs that have been used with varying success in the treatment of eclampsia. The first is forbidden by long continuance of the paroxysms and profound coma.

Nitrite of amyl was first used upon[5] the suggestion of Dr. Weir Mitchell, by the late Dr. W. F. Jenks, of Philadelphia; in the case in which it was employed the eclampsia began in labor and continued afterward uninfluenced by ether inhalation; the effects of inhaling a few drops of nitrite of amyl were most remarkable, the eclamptic attacks being at once arrested; but the patient had severe uterine hemorrhage, which Dr. Jenks attributed to the action of the drug.

Budin[6] tried the remedy in a case of eclampsia in pregnancy, but without any effect.

Fearn,[7] Boyd,[8] and Kenyon[9] have reported cases of eclampsia successfully treated by veratrum viride. In one case Boyd gave twenty drops of the fluid extract every fifteen minutes, until one hundred and twenty drops had been taken; at the time the last dose was administered

1 Obstetric Gazette, Feb. 1882.
2 Paris Thesis, by Chambert, 1883.
3 American Journal of Obstetrics, 1880.
4 London Lancet, July 16, 1881.
5 Philadelphia Medical Times, August, 1872.
6 Obstétrique et Gynécologie.
7 American Journal of Obstetrics, 1871.
8 American Practitioner, 1878.
9 New York Medical Journal, 1879.

the pulse had fallen from 144 to 130; in ten minutes the patient vomited, and the pulse fell to 54.

The inhalation of oxygen has recently been used, more especially by Russian physicians, with some success in the treatment of eclampsia.[1]

Breus[2] has treated twenty-four cases with hot baths; the temperature of the bath when the patient is put in it is 100.4 F., and it is increased to 110 F. or more; she is kept in half an hour, and after being taken out, is covered with blankets; by these means copious diaphoresis is secured. Only two patients died. But it should be remembered that he conjoined with this treatment narcosis by chloral injected into the rectum, assisted if necessary by chloroform inhalations. The labor was terminated as soon as possible without danger to the mother.

Obstetric Treatment.—In nearly one-third of the cases of eclampsia, convulsions cease if the uterus be emptied; and therefore all obstetricians agree in facilitating labor if it comes on, as it does in the great majority of cases. Free the uterus of its contents as soon as this can be done without the least violence, was the teaching of Dubois. Artificial dilatation of the os, and delivery by turning or by forceps, may be indicated in some cases. But of course whenever artificial means are used for hastening the labor, chloroform or chloral must also be employed to prevent reflex irritation.

But if the eclampsia occur and no uterine action follow, while the convulsions do not yield to treatment, should uterine action be excited by the obstetrician? Authorities differ. Pajot, for example, has condemned it as unreasonable, and more dangerous than eclampsia itself. The arguments against the practice are, chiefly, the convulsions may continue after delivery, or they may end before this can be effected; they may cease, and the pregnancy be completed. If the eclamptic attack be severe, uterine contractions generally occur spontaneously. The irritation of a uterus unprepared for labor is liable to add to the severity of the convulsions.

The force of these arguments must be admitted, but, on the other hand, there is being accumulated a number of cases where artifiicial means were used to empty the uterus, and the patients recovered. The induction of labor in cases of eclampsia where the mother's life is in danger, where the disease resists the best directed treatment, has received the endorsement of some of the ablest American obstetricians, among whom may be mentioned Barker, Busey, and Lusk. But the practitioner who determines—and, as a rule, the determination should only be made after a consultation with a competent confrère—upon this course, must be prepared for the possibility of his patient dying after, and in spite of the induced labor, just as in some instances happens after a spontaneous labor in the eclamptic.

If eclampsia begins, or continues after labor, the chief therapeutic means are chloral, or morphia, and chloroform inhalation. Caution must be taken not to use these agents in too large quantities, and especial care not to anæsthetize the patient too profoundly, lest the artificial sleep end in death.

[1] Centralblatt für Gynäcologie, 1885.
[2] Archives de Tocologie, September, 1884.

CHAPTER X.

DISEASES OF THE SEXUAL ORGANS—DISEASES OF THE OVUM.

Vegetations of the Vulva.—Papillary hypertrophy may occur at various parts of the vulvar surface, giving rise to wart-like elevations, in the pregnant woman. While probably in the majority of cases these growths have a specific origin, yet in some it is believed that they may occur from the irritation of parts rendered more vascular by pregnancy. They are like plants that spring up luxuriantly from a moist soil. The proof of their non-specific character is given by the fact that they usually spontaneously disappear when the pregnancy is over. They may occupy the nymphæ, the vestibule, the hood of the clitoris, the labia majora, and adjacent skin, the vaginal orifice, and in some cases extend into the vagina.

Unless large, and occupying so much space that they obstruct the birth-canal, active treatment in pregnancy is not advisable, for excision might be attended with considerable hemorrhage, and followed by abortion or premature labor, or inflammation of lymphatics or veins. When the growths are removed they are very liable to return, and their probable spontaneous disappearance after pregnancy are additional reasons for refraining from active treatment. The surfaces affected should be kept apart as much as is possible, and disinfectant or astringent solutions applied; one of the best of local applications is a solution of carbolic acid. Charpentier states that in two pregnant women these growths disappeared by isolating the affected parts, and applying compresses dipped in Labarraque's solution.

Prolapse of the Vagina.—This is to be treated by astringent injections, by having the bladder frequently emptied, especially if, as is frequently the fact, a cystocele is associated with the prolapse, and by wearing a suitable pessary; the elastic ring will in most cases be best; if a pessary cannot be worn, a large tampon of absorbent cotton dipped in a mixture of tannin and glycerine may be used; this tampon should be removed each night and a fresh one introduced in the morning.

Leucorrhœa.—It is not uncommon for a pregnant woman to have a more or less abundant milk-like discharge from the vagina; it arises from a simple or catarrhal vaginitis, induced in part by the increased congestion of pregnancy. Another form of vaginitis may also occur; it was first described by Deville in 1844, and called by him granular vaginitis; he believed it peculiar to pregnancy, but it may occur in the non-pregnant, though more frequent in the former condition. It is characterized by the formation of a large number of hemispherical elevations about the size of a hemp-seed upon the vaginal surface,

making it rough, by burning and itching, and by a rather profuse yellowish discharge which irritates the parts with which it comes in contact in passing out of the vagina. Other vaginal discharges may be caused by gonorrhœal infection, or by cervical endometritis.

Winckel described in 1871 a condition which he observed in three pregnant women, and which was characterized by the presence upon the vagina of a vast number of transparent cysts, fifteen or twenty being found upon a spot the size of a dollar, and usually associated with hyper-secretion; most of the cysts contained gas, and when punctured collapsed with a sound readily heard. He named the disease colpohyperplasia cystica.[1]

The treatment of the vaginal discharges of pregnancy will be, in the slighter cases of increased secretion, by tepid injection of solutions of astringents, as of alum, borax, salts of zinc, etc.; in severer cases, in addition to cleansing injections of a two per cent. solution of carbolic acid, of potassic chlorate, or of common salt, a cotton tampon inclosing half a teaspoonful of powdered alum and of subnitrate of bismuth, may be passed to the upper part of the vagina, and left there for twelve or twenty-four hours, when, by means of a string which has been tied to it before its introduction, it is removed; the tampon may be repeated the following day. Instead of the dry tampon just advised, one of cotton dipped in a mixture of boric acid and glycerine, 1 to 10, may be used, or of tannin and glycerine. If the vaginitis be gonorrhœal it will be advisable, in addition to the means that have been mentioned, to apply with a brush a solution of nitrate of silver to the exposed vaginal wall, or to use injections of a solution of corrosive sublimate; during labor the vagina should be well cleansed, a disinfectant solution being used, so if possible to prevent the contact of any infectious matter with the child's face, lest some of it might find its way to either conjunctivæ, and a specific conjunctivitis result.

Positional Disorders of the Uterus—Prolapse and Procidentia.—In prolapse of the uterus the organ is still within the vulvar orifice, when it protrudes from that orifice there is procidentia. The uterus is usually somewhat lower in the first three months of pregnancy, but in the fourth month the organ begins to ascend, and most cases, even of pathological prolapse, are thus spontaneously cured. But in the pregnant as in the non-pregnant condition the same causes—such as sudden pressure upon the abdomen, or a fall, or jumping from an elevated position—may, especially if the bladder be full, cause acute uterine prolapse. Most cases, however, of prolapse of the uterus in pregnancy are those in which the prolapse was present before the pregnancy, for even procidentia of the uterus does not prevent impregnation, as the organ may be spontaneously replaced when the subject lies down; and further, instances where coition occurred through the dilated os have occurred. Some cases of apparent prolapse of the uterus are explained by hypertrophic elongation of the cervix. Kleinschmidt[2] has narrated a case of prolapse of the uterus in pregnancy,

[1] See Winckel's work on Diseases of Women for full description.
[2] American Journal of Obstetrics, vol. xviii.

the organ protruding about an inch from the vulva if the patient was erect, when the pregnancy was only six weeks advanced; at six months and a half the protrusion still remained, even when the patient was recumbent, and a bandage was worn to support the organ. Kleinwächter states that in case of considerable prolapse and injudicious treatment, especially if reposition be neglected, the organ may become incarcerated, and the pregnancy thereby be arrested. He denies that it is possible in case of complete prolapse or procidentia for the pregnancy to be completed, because of the injuries to which the organ is exposed. A similar assertion is made by Lusk. Nevertheless Stoltz[1] states that very numerous facts prove that the pregnancy may arrive at term. The same statement is made by Corre.[2]

The treatment of prolapse of the uterus is reduction, the recumbent position for the patient, and the wearing of a suitable pessary. If the organ be irreducible, and protrude externally, a bandage must be worn to support it when the patient is on her feet.

Anteflexion and Anteversion of the Uterus.—Anteflexion of the pregnant uterus is an exaggeration of the original condition, and therefore is by most regarded as normal, though very great importance is attached to it by Graily Hewitt as a cause of vomiting; it very seldom reaches such a degree as to be pathological. The rule is that if the uterus be greatly anteflexed, sterility results, caused not so much by the displacement, but by conditions associated with it. An anteflexion, or an anteversion, in the earlier months may cause great irritability of the bladder and other inconveniences; but unless some pathological condition be associated with the positional disorder, it is not probable there will be any arrest of pregnancy; nor does it seem possible that the uterus can become incarcerated, and its fundus fixed behind the pubic joint. Anteversion of the uterus is physiological in multigravidæ in the latter part of pregnancy, for the relaxation of the abdominal wall permits the uterus to fall forward; if this relaxation be very great the uterus may rest upon the thighs when the patient is sitting. The condition is sometimes spoken of as hanging belly, or pendulous abdomen. Very great discomfort may result from this condition in pregnancy, and the entrance of the head of the fœtus into the pelvic cavity be hindered. In labor the uterine contractions work at a great disadvantage from the malposition of the womb. The remedy is found in a firm, properly applied bandage.

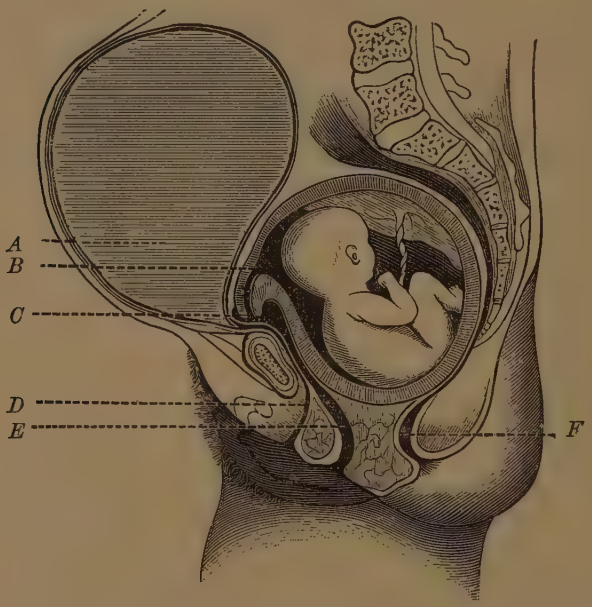
Posterior displacements of the uterus in pregnancy are graver conditions. A woman with a retroverted uterus rarely becomes pregnant; hence, if the uterus be found retroverted in pregnancy, it is probably an accident that has occurred after pregnancy has begun. On the other hand, a woman who has a retroflexed uterus may become pregnant more frequently than one whose uterus is in the normal position, since the deviation is very often the cause of abortion. In regard to the occurrence of retroversion of the pregnant uterus, there has been much

[1] See Dystocie, Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome douzieme.

[2] Manuel d'Accouchement et de Pathologie Puerpérale. Paris, 1885.

controversy as to whether the deviation is sudden or gradual, and as to whether distension of the bladder is cause or consequence. It may be admitted that each form of displacement can take place—that is, in some cases it is gradual, in others sudden, and that distension of the bladder may occasionally be a cause, while in all cases it is one of the gravest consequences of the change of position.

FIG. 97.



RETROFLEXION OF THE GRAVID UTERUS WITH INCARCERATION.—*A*. Bladder. *B*. Internal orifice. *C*. External orifice. *D*. Urethra. *E*. Vagina. *F*. Rectum.

Probably in the majority of cases of posterior displacement of the gravid uterus spontaneous cure occurs, the uterus gradually rising out of the pelvis. Further, in some cases of retroflexed uterus, as first suggested by Merriman, and as confirmed by the observations of Oldham[1] and Stillé,[2] pregnancy may go on to term, or near it, though the uterus remains retroflexed.

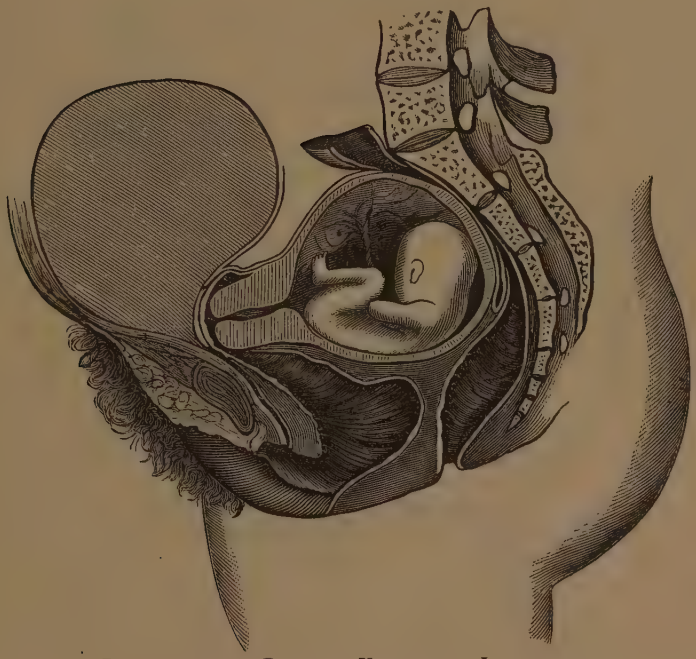
Oldham's case was one in which at term he found the head of the child occupying the fundus of the uterus, which was in the pelvic cavity, while the lower segment of the uterus was raised considerably above the pelvic brim. He succeeded in delivering the woman of a dead child, by first introducing the finger into the child's anus, failing to reach the bend of the child's thigh, thus exerting traction, and he was enabled after considerable effort to draw the breech a little lower, and some elevation of the head followed; then pressure upon the lower part of the tumor, while external pressure was made, caused the fundus to ascend above the brim

[1] London Obstetrical Society's Transactions, vol. i. [2] Memorabil, 1881.

and into the abdominal cavity; the os uteri now being accessible, a foot was brought down, and the child delivered. In Stillé's case a retroflexion at the fourth month of pregnancy caused retention of urine, but no interference with evacuations from the bowels. Replacement being impossible, daily catheterization of the bladder was done; development of the uterus continued, the child's head remaining in the pelvic cavity, the body above. Labor came on seven weeks prematurely, and delivery was accomplished by podalic version.

Further, nature may end the case by abortion; this result is not unfrequent; but, none of the events which have been mentioned occurring, symptoms of incarceration supervene. The uterus, confined

FIG. 98.



RETROVERSION OF PREGNANT UTERUS WITH INCARCERATION.

to the sacral cavity, possibly by the adhesions of an old peritonitis in some cases, continues its development; there result retention of urine and obstruction of the rectum; uræmia and local or general peritonitis may occur; the bladder may rupture, or there may be either a simple or diphtheritic cystitis from retention of urine, and, as a consequence, detachment of the whole or of parts of the vesical mucous membrane. Valenta[1] has reported a case in which retroflexion in the fifth month caused gangrene of the bladder, perforation into the small intestine, and death of the patient.

The diagnosis of retroflexion or of retroversion of the pregnant uterus

[1] See Kormann.

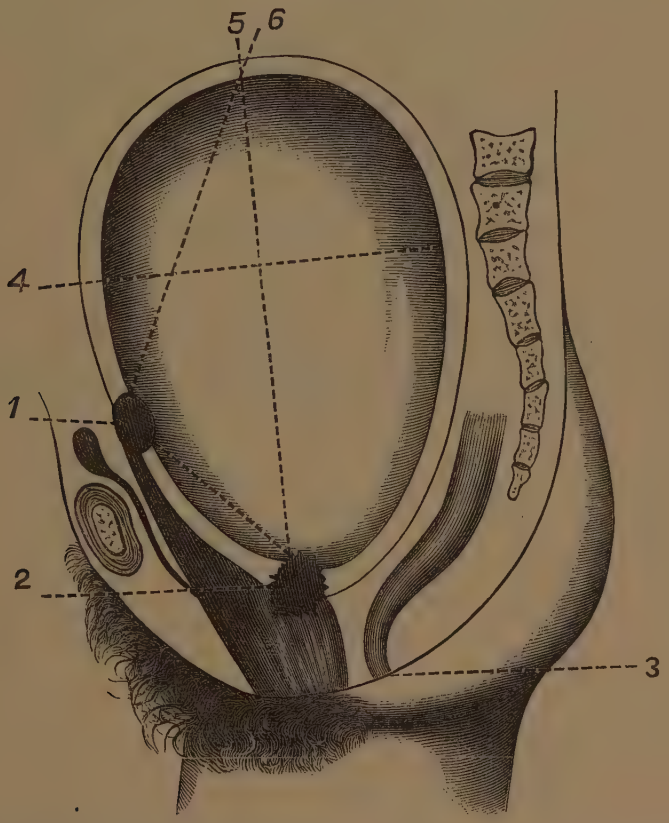
will not usually present any great difficulty. First, the fact of pregnancy is to be established; next, the bladder is to be emptied, a flexible catheter being used for this purpose, and in case it is impossible to use a catheter, aspiration would be preferable to leaving the organ distended; then digital examination by the vagina, and by the rectum; and, finally, bi-manual examination ought to remove all doubts as to the nature of the disorder.

Having discovered the displacement, the treatment will be, in the simple cases where the uterus is mobile, digital or bi-manual replacement of the organ, and the wearing of an Albert Smith or Hodge pessary. The patient ought to avoid any compression of the abdomen, constipation, straining at stool, and allowing any accumulation of urine in the bladder. She should each day occupy the knee-chest position for a short time, and when recumbent should avoid, as far as possible, being upon her back. At four months the pessary may be removed. In other cases, where the uterus is not mobile, and if no evidences of inflammation are present, efforts at gradual reposition may be made as follows: Let the patient take the knee-chest position; then the practitioner may, by two fingers introduced into the vagina, press upon the posterior wall of the uterus, or the fingers may exert this pressure through the rectum; no violence should be used; generally immediate reposition is not expected, but a slight gain being made from day to day, final success may be obtained after a week, or even longer time. Another method, either employed alone or assisting that which has been given, is to introduce into the vagina the broad blade of Sims's speculum, the broader the better, and with it not only draw back the perineum, but also press up in the posterior vaginal cul-de-sac, thus pushing the body of the uterus up, and at the same time drawing the neck backward; the last action may be assisted by seizing the cervix with a tenaculum, and drawing it toward the posterior vaginal wall. This entire method may be summarized in *push and pull.* Let the operator, however, always have as his motto, *non vi sed arte.* Another method which counts some successes is the use of continuous elastic pressure, by means of a rubber bag distended with air or water, introduced into the vagina or into the rectum. But neither organ is very tolerant of such an instrument; this is especially true as to the rectum; moreover it does more harm than good when the pressure is made through the vagina if the fundus of the uterus be lower than the cervix, for then the pressure will be greater upon the latter than upon the former. I doubt, indeed, whether it is of any value, even if the uterus is simply transverse; the space furnished by the rectum below the retroverted uterus is so small that but slight force can be exerted through it. If an anæsthetic is used when efforts at reposition are made, of course the patient cannot be in the knee-chest position, but must lie upon her back or upon her side. If reduction be impossible, and symptoms of incarceration occur, the only remedy is the induction of abortion.

Sacciform Dilatation of the Posterior Wall of the Uterus.—A condition rarely observed, and which has been mistaken in some cases for retrover-

sion of the pregnant uterus, was very fully described by Depaul[1] in 1876. It has been called sac-like dilatation of the posterior wall of the uterus. The subjoined diagram represents the post-mortem appearance of

FIG. 99.



SACCIFORM DILATATION OF THE POSTERIOR WALL OF THE UTERUS.—1. Os uteri. 2. Artificial os. The distance between the two was about three inches and a half, 9 centimetres. The distance from the fundus of the uterus (6) to the os was 6.7 inches, or 17 centimetres, while that extending from the same point (5) to the new opening was nine inches, or 23 centimetres. The distance from the os to the median point of the fundus was, following the curve of the anterior wall, 8.2 inches, 21 centimetres, but following the curve of the posterior wall, 18.1 inches, 46 centimetres.

the uterus of a patient under the care of Depaul. It was impossible for him to find the os uteri, the patient being in labor, and he made an opening through what the autopsy proved to be the posterior wall of the uterus. The patient died undelivered.

Hernia of the Uterus.—In rare instances the pregnant uterus has in part protruded at the abdominal ring, the disease being known as

[1] Archives de Tocologie.

uterine exomphalos, or uterine umbilical hernia. In Murray's case[1] more than two-thirds of the uterus thus protruded in the latter part of pregnancy; reduction was readily accomplished, and a bandage prevented reproduction of the hernia. In Oliver's case,[2] not seen until labor began, a cone-like mass—the base of the cone being at the umbilicus—was observed projecting from the abdomen. After the delivery of the child the tumor was still evident, and proved to be the upper portion of the uterus containing an enormously developed placenta, the weight being eight pounds, as estimated[3] after its expulsion. Reduction of the hernia was readily effected. The woman had umbilical hernia in childhood.

Examples of herniæ in pregnancy resulting from dilatation of an abdominal cicatrix have been given by Boivin and others. More frequently, however, herniæ of the linea alba have been observed; separation of the recti muscles occurring, the uterus projects in the interval.

Prochownick, in a recent paper upon diastasis of the abdominal muscles in childbed,[4] states that English women are less liable than German women to pendulous abdomen after confinement, because they remain longer in bed, and especially because they wear well-fitting bandages after getting up. His consideration of the disorders that arise in the lying-in from diastasis of the recti muscles will be referred to elsewhere.

The treatment of ventra hernia is the same as that of pendulous abdomen.

Crural, and Inguinal Hernia.—Winckel[5] remarks that in view of the possibility of the uterus entering into the various canals passing from the false and from the true pelvis, such terms as inguinal hernia of the uterus, crural, obturator, ischiatic, etc., have been used, but as a matter of fact the uterus has been found only in the hernial sac of inguinal and crural hernia.

Eisenhart[6] states that hernia of the gravid uterus is nearly as rare as hernia of the non-gravid organ; the slight preponderance in number of the former is probably due to the fact that pregnancy directs attention to a condition which would otherwise be unnoticed. In his historical references, he says that Nicolaus Pol, 1531, reported the first case; Cæsarean section was done, the mother survived three days, the child lived to be one year and a half old. In April, 1610, Sennert operated on a case, the mother lived twenty-five days, and the child until nine years and a half old. Saxtorph's and Lédesma's cases are next given; the latter occurred in 1840. Rektorzik reported a case in 1860; the Cæsarean operation was done, the mother died, but the child lived. Inguinal hernia is frequently associated with uterus bicor-

[1] London Obstetrical Society's Transactions, vol. i.

[2] Western Journal of Medicine, 1867.

[3] In a private communication Dr. Oliver states that he did not weigh the placenta, but he did the child, its weight being but four and a half pounds, and the placenta seemed to be nearly twice as heavy. The heaviest placenta mentioned in obstetric works, I believe, is that described by Stein, and referred to by Velpeau—the weight being six pounds.

[4] Archiv für Gynäkologie, 1886.

[5] Op. cit.

[6] Archiv für Gynäkologie, 1885

nis or didelphys. In Winckel's case, reported by Eisenhart, the hernia occurred suddenly in the fourth month of pregnancy; the right horn of the uterus was concerned. Scanzoni has reported a case of inguinal hernia in which two pregnancies occurred in one year; one of the pregnancies ended by spontaneous, the other by artificial abortion.

In these herniæ Winckel advises abortion. If the fœtus be viable, the Cæsarean section should be done at the end of gestation, and then, if the uterus can be restored to the abdominal cavity, this should be done, but if it cannot be, it should be removed.

Structural Diseases of the Uterus.—Two only of these require consideration, fibroid tumors and malignant growths.

Fibroids of the Uterus.—A relative sterility results from fibroid tumors of the uterus; thus while the average sterility of women is one in eight, that of those having these growths is one in three. In the great majority of women having uterine fibroids pregnancy is not interrupted; if the tumors be situated at the fundus, it is thought abortion in the earlier months is very liable to occur; placenta prævia is very much more frequent in cases of fibroids. The tumors usually increase in size, and become softer during pregnancy, and after pregnancy may greatly lessen in bulk; but such changes are observed more especially in those that have a predominance of muscular tissue, myomata.

The treatment of fibroid tumors in pregnancy is chiefly symptomatic. Thus, if the tumor becomes incarcerated in the pelvic cavity, an effort should be made to push it up in the false pelvis; if hemorrhage occurs rest, cold drinks, opium, or finally the vaginal tampon may be employed. Schroeder succesfully removed a pedunculated, rapidly growing uterine subserous myoma in the third month of pregnancy by laparotomy; the pregnancy was not interrupted. A similar result attended the operation of Thornton, done a few months earlier than Schroeder's, and those of Landau and Studsgaard; Péan's patient recovered from the operation, as did also Braun's, but each aborted; Barnes's and Hegar's patients died.[1] So, too, supra-vaginal amputation of the uterus was successfully done by Kaltenbach. But partial amputation or supra-vaginal amputation, including Kaltenbach's case, was followed by death in four out of nine cases.[2] If the tumor occupies the lower segment of the uterus, and be so large that the birth of a living child is impossible, even though premature labor be induced, the question of abortion may be presented, or either the Cæsarean section or craniotomy will be necessary, if the pregnancy is completed. If the tumor occupies the cervix, it may be possible in some cases to enucleate it during labor, and thus remove all obstruction to delivery.

Malignant Disease of the Uterus.—If cancer or sarcoma occupy the fundus of the uterus, there is little probability of pregnancy occurring, and a certainty of abortion should it occur. Cancer of the neck does not present such hindrance to pregnancy, and the latter, provided the

[1] Du Traitement Chirurgical des Myomes Utérins. By Dr. A. Vautrin. Paris, 1886.
[2] See Vautrin's Statistics.

malady involves only the vaginal portion, most frequently continues to term. The disease is in almost all cases unfavorably affected by gestation. Should the cancer be limited to the vaginal cervix, and show any progress, amputation ought to be done at once. The operation has been performed in some cases without interruption of the pregnancy. Even when the affection is more extensive and gives rise to copious purulent and hemorrhagic discharges, an operation for partial removal of the cervix, taking away all the diseased tissue possible, is proper. The induction of abortion or of premature labor is not generally regarded with favor, nevertheless, in some cases the alternatives are, when labor comes on spontaneously, craniotomy or the Cæsarean operation.

Diseases of the Breasts.—Occasionally mastitis is seen in the latter part of pregnancy, the disease being in most cases probably traumatic; Schroeder, however, speaks of its occurrence from tumors as exceptional. The treatment is not modified by the pregnant condition, nor does the former have any disturbing influence upon the latter, unless very high fever occurs. Malignant disease of the mammary gland usually makes more rapid progress during pregnancy; hence the indication is plain as to removal of the diseased structure without waiting until the pregnancy ends. According to Verneuil adenomata of the breast are either not affected by, or diminish during pregnancy.

Ovarian Tumors.—If an ovarian tumor be small, it presents no serious interference, if any, with pregnancy. But if the tumor be large the pregnancy in many cases ends in abortion, or in premature labor. Other accidents are inflammatory adhesions between the tumor and the fundus of the uterus, rupture of the cyst wall, twisting of the pedicle of the tumor, and consequent gangrene. In some cases, where the tumor is not large, it may become wedged in the pelvic cavity.

The treatment of ovarian tumors, so long as they do not give the patient discomfort and threaten the pregnancy, is expectant. But when the tumor is fixed in the true pelvis, an effort should be made, with the patient occupying the knee-chest position, to push it up out of the pelvis. Large tumors are to be treated by abortion, tapping, or ovariotomy. The first is generally rejected, and the second is only applicable to a monocyst, or to a tumor which is composed chiefly of one cyst. The general professional sentiment is in favor of ovariotomy if the tumor be large; the results are usually good, and especially if the operation be done early in the pregnancy.

The following facts and conclusions are found in a recent valuable monograph by Remy.[1] In eleven cases of pregnancy complicated with ovarian tumor occupying the abdominal cavity, in which premature labor was induced, three mothers died, and of the eleven children only five lived. Puncture of the cyst, according to Heiberg's statistics, has a maternal mortality of 22.5 per cent., and a fœtal mortality of 37.5 per cent. Ovariotomy in pregnancy was first suggested by Merriman in 1817, and was first successfully done by Marion Sims; the operator, however, did not know before the operation was begun that the patient was pregnant.

[1] De la Grossesse compliquée de Kyste Ovarique. Paris, 1886.

The mortality for mothers from ovariotomy in pregnancy is, when the operation is done in the first four months, 11.3 per cent., and for the fœtus 42 8; if the operation be done in the last five months the maternal mortality is 16.6 per cent. and the fœtal mortality 50 per cent. Expectation—of course it is presumed that the ovarian tumor is of considerable size—gives a maternal mortality of 39.2 per cent. and a fœtal mortality of 67 per cent.

Schroeder[1] has recently done his fifteenth ovariotomy in pregnancy, the recovery of the patient without interruption of the gestation being almost certain. The fourteen others recovered, and thirteen children were born living, one of them being born at the eighth month.

Diseases of the Ovum.—The ovum includes the deciduous membranes, the chorion and the amnion, the amniotic liquor, the fœtus, placenta, and cord. The pathology of the ovum, therefore, will embrace that of the several parts of which it is composed. The ovum may occupy an abnormal position, and hence a variety of pregnancy known as ectopic gestation. Again, instead of the entire ovum occupying an abnormal position, the placenta alone may be in such position, and thus ectopic development of it occur, constituting that form of disease described as placenta prævia, the most prominent symptom, in almost all cases, being a variety of hemorrhage which has been called *unavoidable.* The placenta, occupying its normal position, may be prematurely detached in part or entirely, and another variety of hemorrhage, identical in source, but differing in etiology, called *accidental* hemorrhage result. These conditions will be considered under the head of the pathology of the ovum. As a consequence of maternal or of fœtal disease, or of trauma, the ovum may be expelled prior to the time when the fœtus is viable, and abortion, the gravest accident to the pregnancy, is to be considered.

Decidual Endometritis.—While parenchymatous endometritis rarely occurs in pregnancy, inflammation of the decidua is very frequent, and in many instances leads to abortion. The decidua, furnishes,[2] as Martin Saint-Ange expresses it, an incubating chamber for the impregnated ovule, and if the former become diseased, injury to the latter is very likely to result. Decidual endometritis may be either acute or chronic. The former is caused by acute febrile diseases, is especially characterized by hemorrhage, and its usual consequence is miscarriage.

Four varieties of chronic decidual endometritis have been described. 1. *Diffuse decidual endometritis.* This usually affects the parietal, or uterine decidua, decidua vera, rather than the decidua reflexa, the ovular decidua; it is characterized by the thickening of the decidua from proliferation of the decidual cells, and development of the connective tissue; subjacent muscular fibres may also be involved in the hyperplasia. 2. *Polypoid decidual endometritis.* Here, with chronic proliferation and thickening of the decidua vera, polypoid growths appear; these are about three-fourths of an inch in height,

[1] Remy, op. cit.

[2] Iconographie Pathologique de l'Œuf Humain Fécondé.

and are broad-based, and irregular in form. If polypoid endometritis occur early, the inflammatory process readily extends to the chorial villi, with resulting atrophy of the ovum, and abortion; upon the aborted ova the manifestations of diffuse and of polypoid decidual endometritis may be seen.[1] 3. *Cystic decidual endometritis.* In this form of decidual endometritis the inflammation involves the glands of the mucous membrane; the intra-glandular connective tissue is increased, and the membrane is swelled; hence obstruction of the gland ducts, and retention of glandular secretion with the formation of cysts. In other words, they are retention cysts. 4. *Catarrhal decidual endometritis.* The characteristic indication of this disease is the discharge from time to time of a watery fluid from the uterus, constituting what is generally known as *hydrorrhœa gravidarum.* The disease is more frequent in multigravidæ than in primigravidæ; it may occur as early as the third month, but usually not until the late months of pregnancy. The fluid is albuminous, and generally yellowish, and at times may contain blood. The probability seems to be that its chief source at least is the uterine glands. At first it appears between the decidua vera and the decidua reflexa, but after these are united the transudation must be between the chorion and the reflexa; the occasional presence of blood in the discharge from the uterus is probably explained as resulting from the fluid, after passing by partial rupture of the decidua to the outside of the ovum in its descent, causing detachment of a part of the decidua from the uterus. Many of the cases of supposed rupture of the membranes, days or weeks before labor, are really examples of hydrorrhœa, a discharge of false waters, not of the amniotic liquor, occurring. Slight pains usually accompany the discharge, and in most cases it is repeated several times before pregnancy ends. Premature labor very rarely follows hydrorrhœa, but its possible occurrence indicates that the patient thus affected, especially if there be any uterine contractions, should remain lying down, and in some cases a rectal injection of twenty to thirty drops of laudanum will be advisable.

The causes of decidual endometritis are not well known. In some cases the disease may arise from syphilis, or from great bodily effort, or from excessive work; in others, it was present prior to pregnancy, and in still others it follows the death of the fœtus.

Diseases of the Placenta—Apoplexy of the Placenta.—Hemorrhages into the placental tissue rarely occur. If happening early in pregnancy, they take place near the fœtal surface; but if late, near the maternal surface of the organ, according to Desormeaux and Dubois. Hemorrhage is very rarely seen at the fœtal surface, beneath the amnion. In some cases the hemorrhage is into the maternal sinuses. The extravasation may be single or multiple. The size of the apoplectic masses varies from that of a pea to that of a hazelnut or of a pigeon's egg. They at first appear as circumscribed, blood-red extravasates; afterward they lose their deep hue, and become grayish-red, or yellowish-white, fibrin-like masses. Kleinwächter states that in most cases inflammation of the placenta is the cause of the hemor-

[1] Archiv für Gynäkologie, 1885. Breus, Ueber cystöse Degeneration der Decidua vera.

rhages. If the effusions are multiple or large, they may by pressure upon the adjacent chorial villi interfere with the nutrition of the fœtus.

Placentitis and Placental Sclerosis.—After being a subject of controversy for several years, it seems now to be admitted that inflammation of the placenta may occur. Nevertheless the disease is oftener seen in its result, sclerosis, than in its progress. No case has been adduced conclusively proving suppuration as a result of placental inflammation; Robin,[1] on the other hand, has shown that the liquid contained in the supposed abscesses of the placenta was only a fibrinous pseudo-pus, very different from true pus. Sclerosis is manifested by the presence in the placental tissue of circumscribed connective-tissue nodules of various sizes. They should not be confounded with the transformed clots occurring in placental apoplexy. These nodules are sometimes found in the fœtal, at others in the maternal placenta, or in both. In consequence[2] of the new connective-tissue formation the placental villi concerned are atrophied, and undergo a fatty change with, at the same time, a deposit of calcareous concretions and pigment. Partial placentitis is seldom seen limited to the placental tissue; most frequently it has its origin in inflammation of the serotine decidua, but it may happen that the affection of the decidua is subsequent to that of the placenta. In some cases endometritis preceded the pregnancy, in others it has arisen during it. The result may be firmer adhesions between the placenta, the decidua serotina, and the uterine wall, so that after the expulsion of the child, the uterine contractions fail to detach the placenta. Bustamente's description of sclerosis of the placenta is thus given by Charpentier:—

> The alteration appears in the form of a reddish, fleshy, lobulated, and smooth mass, presenting a resemblance to the thymus. The affected part partially adheres to the villi of the sound part. Towards the sides, and especially upon the fœtal face of the placenta, the normal tissue is pushed back and even compressed, which may be seen when the diseased part is removed. At the level of the mass thus affected, the mucous layer that covers the uterine surface of the placenta can be removed, which is impossible in the normal state.

Fatty Degeneration of the Placenta.—Dr. Robert Barnes[3] makes an important distinction between fatty degeneration and fatty metamorphosis; the former begins in living, while the latter is found in dead tissues. He describes fatty degeneration of the placenta as "generally partial, invading one or more cotyledons, or part of them, forming in many cases diseased masses imbedded in comparatively healthy tissue, thus giving evidence that it originated during the life of the fœtus. In some instances we find, indeed, a living fœtus with a placenta in part affected; in others we find the disease more advanced and the fœtus dead, but with some healthy placenta, the vessels still containing blood. To the naked eye the fatty placenta may exhibit masses of a yel-

[1] Marchal, Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxviii.

[2] Kormann.

[3] Dr. Barnes's first publication upon the subject was in the Medico-Chirurgical Transactions, 1853.

lowish pale color, more solid than the spongy, healthy tissues surrounding them, and easily friable." Among the consequences of fatty degeneration of the placenta is abortion. Dr. Barnes also states that this change may explain some cases of hemorrhage during gestation which are attributed to placenta prævia.

Syphilitic Disease of the Placenta.—The study of the changes in the placenta resulting from syphilis is quite recent. The following admirable summary of his investigations of the subject is given by Zilles :[1]—

Macroscopic Examination of Placentæ from Syphilitic Mothers.—The placenta is of massive development and of great weight, in comparison with the imperfect development of the fœtus. In most instances the placenta is pale-red in general color, and yellowish-white in the diseased portions. Here and there the tissue is firmer, more resistant, compact, and more friable than the normal placenta. At various points "gummatous" nodules are found; these are wedge-shaped, nodulated, fibrous formations, with bases in the decidua, and lessening in size in the fœtal portion of the placenta. They vary in size from that of a pinhead to that of a walnut; some are even larger than the last. In some cases they are found occupying circumscribed portions of the entire thickness of the placenta. Upon section the "gummata" show that their structure is formed by concentric lamellæ; the external layers are firmer, and more like fibrous tissue, and have a grayish-yellow color, while in the centre there is a yellowish-red, or orange-yellow, cheese-like, soft, or fluid material. Scattered through the peripheral zone are nodules of a cloudy orange-yellow color, cheesy in character, and about the size of a miliary tubercle. If complete degeneration of the central portion has occurred, an irregular cavity is found, its walls formed of fatty, granular débris, and covered with pus corpuscles. The decidua at the uterine surface is greatly thickened, cloudy, and presents yellowish-white spots. If the fœtus be affected, nodules, such as those previously described, are found under the amnion. The umbilical cord is firmer than normal, and upon section a notable crescent-shaped thickening of the vessels can be seen with the naked eye. There are also to be seen the characteristic nodules, about the size of a miliary tubercle, at some distance from the vessels in the tissue of the cord itself.

Microscopical Appearances.—The decidua contains a large quantity of fibrin, in which are small, round, granular cells. These are found in the meshes of the fibrin, as well as in the fibrin itself; they are scattered, collected in masses, or at times in rows or strands. The cells are also found independently of the fibrin, and presenting the disposition which has been mentioned. In portions the well-known large decidua cells are entirely destroyed, so that nothing remains of normal tissue, but instead there is a luxuriant granulation tissue. In some instances nodules the size of a miliary tubercle are present upon the decidua; their structure is the same as that of the pathological formations found in the organs of syphilitics, and called by Wagner syphilomata. In a fresh state these bodies have an orange-yellow material occupying the centre, which is relatively firm and dry. It proved to be composed of granular, cloudy, non-nucleated masses, with a peripheral zone, composed of compact, small

[1] Studien über Erkrankengun der Placenta und der Nabelschnur bedingt durch Syphilis, von Rudolf Zilles. Tübingen, 1885.

granulation cells. These cells are round, oval, or angular, usually nucleated; some had two or three nuclei. As these are found only in the placentæ of syphilitic women, they may be called *syphiloma of the decidua.*

Sections of the "gummatous" nodules show that they are composed of fibrin, altered villi, and masses of small cells. The villi are united in a compact mass, and surrounded, too, by granular, reticulated fibrin; they are destitute of vessels and of epithelial covering. Some of the inter-villous spaces are rich in small-celled elements; others contain round cells and blood-corpuscles. The villi thus surrounded are club-shaped, and filled with small cells. In some parts of the placenta the villi show calcification. In the periphery of the nodules, as well as in other parts of the placenta, fat granules or fat corpuscles are frequently found. The chorion in cases where both maternal and fœtal syphilis existed, was generally rich in fibrin and in small cells. Sections at the insertion of the umbilical cord showed that the disease extended directly from the chorion vessels to the umbilical vessels, or *vice versa.* The walls of the arteries and the veins of the chorion and of the cord are often greatly infiltrated. In some cases the infiltration extended completely around the vessel, but in others only half around.

The most abundant proliferation, was, as a rule, in the *intima*, but in some instances in the *media.* When the former is affected, there are many white blood-corpuscles attached to the inner surface of the vessels.

The following are the general conclusions which Zilles gives from his investigations:—

1. There is such a disease as placental syphilis, and in many cases it can be diagnosticated by the experienced eye from macroscopic appearances.

2. Placental syphilis is generally, but not always as stated by Fraenkel, associated with fœtal syphilis. The mother may be infected and the child healthy; these are usually cases where she becomes infected during pregnancy.

3. The placenta may be affected throughout its entire thickness, or only either the maternal or fœtal portion. (*a*) When the mother is infected by the fecundating coition, we find, with fœtal syphilis, the placenta more or less affected in all its parts; the cord, too, is usually diseased. (*b*) If the semen alone carry the syphilitic virus, and the mother is not infected, we have fœtal syphilis, and usually only in addition syphilis of the fœtal placenta and of the cord. But it may extend to the maternal placenta, and then the mother is infected. (*c*) In case the mother be infected a short time before conception, the disease not yet constitutional, and the impregnation by a healthy man, if antisyphilitic treatment be employed, a healthy child may be born. In such cases the maternal placenta alone is usually affected. (*d*) If the woman was infected long before conception, usually the maternal placenta only is affected; but the process may extend to the fœtal placenta, and to the fœtus. (*e*) When the mother is impregnated by a healthy man and becomes infected during gestation, the maternal placenta is invariably affected, and usually there is immunity for the fœtus.

The placenta cannot be free from disease if the mother be syphilitic, unless the infection occurred shortly before labor.

4. That a woman may be infected by the passage of a syphilitic fœtus through the birth-canal, and *vice versa*, has not been proved.

5. Experience teaches that during the first few years after syphilis has been acquired, and the disease not treated, the children usually die in the uterus, or are non-viable when born. Suitable mercurial treatment may

subdue the hereditary power of syphilis, or make it latent for a number of years; and this is true, no matter what the stage of the disease. If the disease remain in a latent condition in some of the organs, the effect of treatment may be that for a time healthy children are born, but later syphilitic children.

Myxomatous Degeneration of the Placenta—Hydatidiform Degeneration of the Placenta—Vesicular Mole.—This is a disease of the chorial villi, but whether these are primarily or secondarily affected is not determined. Hecker held that it arose from failure in development of the allantois, a view that is generally rejected. Observations show that in some cases the decidua is diseased, or other pathological conditions of the uterus are present, and that moles are often repeated in the same woman, and these facts indicate a maternal origin of the disease; but, on the other hand, there are cases of twin pregnancy in which one ovum is diseased while the other is healthy.

If the disease begins before the formation of the placenta, the entire chorial surface will be involved; but if after this organ is formed it is limited to the placenta chiefly, and in some instances to a part of the placenta; or there may be but a single cotyledon, or only a small portion of the placenta affected. In the former case the embryo dies, but in the latter it may be perfectly developed, there remaining a sufficient portion of the placenta for its nutrition unaffected.

In myxomatous degeneration the part affected is converted into a vast number of cyst-like formations, there may be five or six thousand; these vary in size, some being as large as an almond, others smaller than currants, and still others so small as to be scarcely visible to the unaided eye; their shape may be spherical, ovoidal, or pyriform; they have been compared to a cluster of white grapes or currants; this comparison is correct as to their general appearance, but it fails, as pointed out by Barnes, in regard to the attachment of the pedicle, or stem of an individual vesicle, for one vesicle gives origin to another, and the pedicle of the latter is connected with the former—"berry grows out of berry, and the stalks do not unite berries with principal stems, but berries with berries, and lastly with a central mother cyst."

Fig. 100.

Hydatidiform Degeneration of the Chorion.

In some cases the entire mass has been expelled inclosed in a sac, the decidua, and this had to be opened to see the peculiar formation. In the centre of the degenerated mass there is usually a cavity found; but if the myxomatous change began early, that is, before the formation of the placenta, and all the chorial villi were affected the nutrition of the embryo

has been so interfered with that death resulted, and the embryo has undergone solution; a little fluid may be found in the cavity, and also the remains of a part of the umbilical cord. In some instances the amniotic cavity has disappeared, but there is almost always found in such case a soft, yellowish, granular, and spongy tissue occupying its space. The death of the embryo is by most regarded as the consequence, not the cause of the disease. When the disease occurs later, involving only a portion of the placenta, it may not be discovered until after the birth of a well-developed child, and the expulsion of the placenta, which upon examination shows the altered structure. The degenerated villi may penetrate by their growth into the uterine sinuses, and destroy the uterine tissue; of course such penetration renders detachment difficult, or perforation of the uterus may occur with resulting peritonitis. One of the accidents that has resulted from this disease is rupture of the uterus.

Various opinions have been held as to the nature of the "vesicular mole," from that of Hippocrates, who regarded it as caused by thickened sperm, to that of Percy and Cloquet, who thought the mass composed of true hydatids; the latter opinion was adopted from de Graaf and Albinus, but Laennec and Percy went so far as to give the name of *tænia hydatigena* to this new animal. Other opinions were that of Sœmmering and Valisneri, who thought the vesicular mole was produced by swelling of the ganglia of the lymphatic system which they found in the placenta, in the chorion and in the amnion, and in the cord; that of Litre, who attributed the affection to hypertrophy of the glands of the cervix, known as the eggs of Naboth, and that of Bartholin and Müller, who thought it originated in dilatation of the placental bloodvessels. In recent years only two opinions have held a prominent position; according to the one the cause is dropsy of the chorial villi, but according to the other, which was advanced by Virchow, there is myxomatous degeneration of these villi; the latter is that which now meets with most general acceptance.

The normal villi of the chorion, as shown by Virchow, have entering into them the same tissue as that which forms the so-called Wharton's jelly of the umbilical cord. Each villus has an external epithelial covering, but the framework, the body of the organ, is formed of mucous tissue. Hyperplasia of this tissue is the essential fact in myxomatous degeneration of the chorial villi. With the increase in volume of a villus the more it presents the appearance of mucous tissue. "The escape of fluid upon puncturing one of these enlarged villi does not prove that a cyst has been opened any more than squeezing a fluid from the cut end of an umbilical cord would show a similar fact." The pedicle of the apparent vesicle is identical with Wharton's jelly. The vessels of the villi are usually obliterated; nevertheless, capillary vessels are sometimes found in the external layers, especially when a part only of the chorion is degenerated, and the fœtus is viable. The contents of the enlarged villi consist of albumen, together with a relatively large quantity of mucin. The fluid is generally clear, but sometimes reddened by dissolved hematine.

The disease is not frequent. Madame Boivin saw but one case in 20,375 deliveries.

Depaul mentioned three important signs. 1. A more rapid development of the abdomen than occurs in normal pregnancy. In one of his patients the uterus was four fingers' breadth above the umbilicus at four months. 2. Attacks of uterine hemorrhage. This symptom has occurred as early as the forty-fifth day, and been delayed as late as the fourteenth month. Discharges of blood may, in some cases, alternate with watery discharges. 3. The expulsion of separate vesicles, or of branches of vesicles. Of course, this sign is conclusive. The pregnancy rarely goes to term; yet, in the 32 cases collected by Boivin, in each of three it lasted until 9 months; in three others to 10 months, while one was not delivered until 11 months; and another at 14 months. The danger to the mother is from the exhaustion caused by repeated hemorrhages, or a single sudden and large hemorrhage may prove immediately fatal. The fœtus in almost all cases dies. Yet there are instances in which an "hydatid" mass has been expelled, and the pregnancy continued to term, when a healthy child was born. Such cases were probably instances of a twin pregnancy in which the myxomatous degeneration affected one ovum, the one that was discharged, while the other remained healthy.

No active treatment is indicated unless hemorrhage occurs. If this be slight, rest, cold drinks, and an opiate may be sufficient; but if it be severe, the tampon should be at once employed. Even should the fact of myxomatous degeneration be proved by the expulsion of hydatids, it does not follow that the uterus should be at once emptied.[1] The dominant fact which guides the treatment is the hemorrhage. If this persists, if it is grave, and only temporarily restrained by the tampon, then dilate the os uteri, and remove the contents of the uterus with hands or instruments, and secure uterine hæmostasis by exciting uterine contraction mechanically, or by ergot, or by electricity; or, if these fail, use intra-uterine injections of hot water, or apply astringent solutions to the interior of the uterus.

Anomalies of the Cord.—Some of these have already been mentioned, such as length of cord, quantity of Wharton's jelly, and false knots.

Coils.—One or more loops or "circulars" of the cord about the infant or one or more of its member occurs in many cases; the most frequent are those in which the cord encircles the neck once or oftener; in some cases an upper or lower limb may be caught in a coil. La Motte gives a case where the cord passed around the neck, then over the chest like a scarf, and under the axilla, and again around the neck. Usually no injurious consequences follow, but in some instances, when the neck is encircled, the loop may become so tight that the circulation in the cord, or in the vessels of the neck, may be interfered with, and the fœtus dies. "If the compression continues after death, the neck may

[1] All the world knows, remarked Depaul, that the celebrated Beclard was the result of a hydatidiform pregnancy. The possibility of a viable child being born, therefore, is the reason for abstaining from active interference in case of this disease, unless symptoms demand such interference.

be so thin that it is almost amputated." Amputation of one of the limbs may result from a tight coil of the cord around it, if continued for some time, even though the fœtus be living. Doléris[1] has narrated a case in which the labor was protracted in consequence of the cord forming a double coil about the lower limbs of the fœtus at the ankles; hence the cord was much shortened, and the fœtus, presenting by the vertex, was as it were suspended by the feet.

It is possible, in some very rare cases, if the abdominal and the uterine walls are thin, to feel the pulsating cord when it encircles the body. Schatz[2] claims that the diagnosis of the cord encircling the neck can be made during pregnancy by auscultation; at first, moderate pressure is made at the part corresponding with the depression of the neck, and the pulsations of the fœtal heart are normal in frequency; but when strong pressure is made their frequency is lessened to one-half.

Knots.—In one out of two hundred infants there will be found at birth one or more knots in the umbilical cord. They result from the

FIG. 101.

KNOT IN THE STAGE OF FORMATION. P. Placental end.

FIG. 102.

INTERMEDIATE FORM.

FIG. 103.

AS IT WAS FOUND AT BIRTH.

fœtus passing through a loop of the cord, and according to most authorities may be formed in pregnancy, or during labor; Read,[3] however,

1 Archives de Tocologie, 1882.
2 Revue Médico Chirurgicale des Maladies des Femmes, 1885.
3 American Journal of the Medical Sciences, October, 1861.

asserts that they cannot be formed, except by the passage of the child through the lower portion of the uterus, for a loop must fall to the vicinity of the os, it cannot remain in any other part of the uterus, and hence they can be formed only during labor; but this view is not generally accepted. Admitting the formation of knots in pregnancy, it is exceptional for the vessels to be so constricted as to interfere with the circulation of blood. Depaul has found in one instance five knots in the cord, quite near together, but the fœtus was living and well nourished. On the other hand, Martin-Saint-Ange has seen death of the fœtus result from a single knot, and many similar cases have been reported. Great length of the cord predisposes to this accident, and a relatively great size of the uterus facilitates its occurrence in pregnancy. The knot is sometimes double, as in a case observed by Dr. George H. Lyman, of Boston. Read gives the representations[1] of the successive stages in the formation of the knot in Lyman's case. (See Figs. 101, 102, and 103.)

Torsions.—Twisting of the cord upon its axis generally occurs, according to Spiegelberg, in the second half of pregnancy, especially in the seventh lunar month. He refers to torsions as "præmortal," and "postmortal." The first are caused by the active movements of the fœtus, or by a severe fall received by the mother. Winckel suggests that the movements of one of the two fœtuses contained in a single amnion may cause twisting of the cord of the other. The "postmortal" torsions are caused by the movements of the mother. Dancing is mentioned by Kormann as a cause of torsions of the cord. They occur more frequently in male than in female fœtuses, the proportion being 13 to 9. Excessive movements of the fœtus, causing torsions of the cord, were attributed by Billi (quoted by Hecker) to disease of the brain. The facility of active and of passive movements, too, in the fœtus of the multigravida being greater than in the primigravida, these torsions are more frequent in the former. Division of the cord may be caused in a short, tense cord by twisting, it being thus separated from the fœtus, so that the latter is unattached in the uterine cavity. The torsions are most numerous in the vicinity of the umbilicus, and next at the attachment of the cord to the placenta. Torsions of the cord may cause occlusion of its vessels, or only stenosis. Death of the fœtus follows occlusion or decided stenosis. In some instances fine thrombi are found in the vessels;[2] these indicate that the torsions occurred suddenly. Fritsch has observed that in some cases torsions occur in successive pregnancies.

Narrowing of the vessels may occur independently of torsions. These stenoses are usually found in the vein near its placental end; "they were first observed by Oedmanson and Winckel, and their anatomical description given by Birch-Hirschfeld."[3] They have been described as sharply defined proliferations of the *intima*, partly of fusiform, partly of round cells, and forming a fibrillated tissue, as a granular matrix with oval and globular nuclei. Beginning in the *intima*, the *adventitia* becomes affected ultimately,

[1] Charpentier in using these illustrations has substituted Leyman for Lyman.
[2] Kleinwächter. [3] Kleinwächter.

and shows an accumulation of lymphoid elements. Birch-Hirschfeld found circumscribed stenoses involving the *intima* of the arteries in the vicinity of the navel and of the placenta; he regards them as resulting from syphilis, stating that the microscopical examination agrees in every particular with those changes which Heubner described as syphilis of the vessels of the brain. According to Spaeth, atheromatous changes may occur in the arteries. Stenosis may be the consequence of periphlebitis, according to Hyrtl. Cysts found in the cord are remnants of the urachus lined with epithelium.

Martin-Saint-Ange[1] narrates a case of a dead fœtus being expelled at seven months, the death caused by complete strangulation of the cord lying between the legs which crossed each other, and were firmly applied together by a convulsive condition.

[1] Op. cit.

CHAPTER XI.

DISEASES OF THE OVUM—DEATH OF THE FŒTUS—ABORTION.

Anomalies of the Amnion and of the Amniotic Liquor.—The question as to inflammation of the amnion, *amniotitis*, is undecided. The formation of amniotic bands, resulting in amputation of fœtal members, or in the production of fœtal malformations and adhesions between the amnion and different parts of the fœtal surface, seem to indicate that inflammation of this membrane does occur. According to some, acute polyhydramnios is the consequence of inflammation of the fœtal membranes. Dareste[1] has shown the important connection between certain fœtal anomalies and the condition of the amnion. The formation of amniotic bands may result from oligohydramnios—that is, deficiency of the amniotic liquor—as follows: The amnion is in contact with parts of the fœtus, not kept separate by fluid, and adhesions result; but with increase of fluid these adhesions are stretched, and thus cords or bands are formed. Another result of deficiency of amniotic liquor is superficial adhesions between the members of the body.[2]

Polyhydramnios.—The most frequent anomaly relating to the amnion and its liquor is that which consists in an excessive production of amniotic liquor, incorrectly designated as hydramnios, or hydramnion, for neither of these words means excess in this fluid. Polyhydramnios exists whenever, acccording to Delore, the quantity of amniotic liquor exceeds two litres, or four pints and two-tenths. Baudelocque stated that the excess might reach to sixteen litres, or even to twenty-five, thirty-three and eight-tenths to fifty-two and eight-tenths pints.

The affection is more frequent in multigravidæ than in primigravidæ, according to McClintock, 23 to 5; more frequent in twin than in single pregnancies, and in the former case the children are oftener of the female sex. The production of monstrosities occurs more frequently in polyhydramnios. Syphilitic disease of the mother has been observed in many cases of hydramnios. In one instance at least, reported by Depaul, the affection occurred in an extra-uterine pregnancy. In some cases of twin pregnancy polyhydramnios was present in one ovum, with oligohydramnios in the other.

Etiology.—Polyhydramnios has been attributed to various causes. According to Jungbluth, the *vasa propria*, which usually become obliterated in the last months of pregnancy, remain open, and hence the disease. The open condition of these capillaries is favored by obstruction in the fœtal circulation, as from congenital defects of the heart (Lebedjew), and diseases of the liver (Küstner). Support[3] is given the

[1] Archives de Tocologie, 1883. [2] Kormann. [3] Kleinwächter.

hypothesis by the greater frequency of malformations and death of the fœtus, and a large and œdematous placenta with polyhydramnios. It has been attributed to excessive activity of the renal function. It has also been thought to result from disturbances in the mother's circulation, as shown by great œdema or by dropsy. In some cases the decidua is greatly hypertrophied, and the chorial villi are swollen. Gervis[1] attributes the affection to inflammation of the amnion, to a diseased condition of the decidua, and to dyscrasia of the maternal blood.

Symptoms, Varieties, and Course of the Disease.—According to Charpentier, the disease does not usually begin before the fifth or sixth month of pregnancy; in many cases, however, it occurs earlier. Gastric irritability, abdominal pains, in some cases, too, inguinal, sacral, or lumbar pain may be present, rapid development of the uterus, and fluctuation are the symptoms of the affection; the last two are the most striking, and they are constant. Associated with the great enlargement of the abdomen from the distended uterus, there may be œdema of the lower limbs, and in rare cases ascites occurs as a complication. The uterus may be as large at five or six months as it is at the end of normal pregnancy. Its walls are tense, so that it is difficult or impossible to recognize the fœtus by abdominal palpation. The lower segment of the uterus is drawn up so that it may be difficult to reach the os; when it can be reached the neck is found shortened, and may have been completely effaced. Accommodation of the fœtus is prevented, and hence the frequency of abnormal presentations. It is difficult or impossible for obvious reasons to hear the sounds of the fœtal heart. The uterus frequently becomes intolerant of its great distension, and symptoms of miscarriage or of premature labor occur; often such result is realized. The great distension of the uterus interferes with respiration, so that attacks of dyspnœa and suffocation occur. The woman's life, however, is in no danger in polyhydramnios, unless the disease be associated with some organic disease, as valvular affection of the heart.

In the ordinary form of polyhydramnios the accumulation of fluid is gradual, and because of the distension increasing slowly, it is better tolerated. But there is an acute form of the disease in which the accumulation of fluid takes place in a few days, or in two or three weeks. Associated with this rapid accumulation there is fever; so, too, vomiting is present. In Montgomery's[2] case a multigravida in the sixth month of a multiple pregnancy, had such rapid enlargement within a week that the induction of abortion was necessary.

Dr. John S. Miller, of Philadelphia, has given me the notes of a case of polyhydramnios which I saw in consultation with him: "Mrs. E., 35 years of age, had previously given birth to six healthy children. At four months in her seventh pregnancy was larger than in any previous pregnancy at term. No fever, but persistent vomiting after fourth month. Circumference at umbilicus, fifty-three inches. Miscarried at six months with male twins; one large, well developed, and lived for a few minutes after birth; the other small, flattened, only about six inches long; the excessive

[1] St. Thomas's Hospital Reports. [2] American Journal of Obstetrics, 1883.

quantity of fluid came from the sac occupied by the larger fœtus. The quantity actually measured was thirty-one pints, but a considerable amount escaped in the bed."

Polyhydramnios occurs probably once in 150 labors: the acute form is very rare. The prognosis for the fœtus is unfavorable; in McClintock's cases, out of 33 children 9 were still-born and 10 died within a few hours after birth—25 of the 33 children were females. Errors in diagnosis are to be avoided, first, by establishing the fact of pregnancy by subjective and objective signs; among the latter, Braxton Hicks's will in some cases be of great value; second, by recognizing the enlargement as being in contact with the abdominal wall in the median line; third, by finding the lower segment of the uterus very high, and more or less complete effacement of the cervix; fourth, by carefully studying the history of the enlargement as to position, as to progress, and as to symptoms produced.

Treatment.—This is palliative and expectant, unless grave symptoms arise from the excessive distension; when these occur the pregnancy should be ended. It has been advised to puncture the membranes high up, and to use the hand as a tampon to check the rapid discharge of the amniotic fluid. Of course, if a transverse presentation occurs, turning must be resorted to, otherwise it is better to leave the labor to nature; it should be remembered that atony of the uterus may result from its very great distension, and hence there is a liability to post-partum hemorrhage, which should be carefully guarded against.

Pathology of the Fœtus.—As observed by Bailly the new being is subjected during intra-uterine life to a very considerable number of pathological states, some dependent upon disturbance in the process of organic evolution, and, therefore, peculiar to it, and others which are the same as those occurring after birth, and hence belonging to the pathology of infancy or of adult life. The first includes vices of conformation of the fœtus, monstrosities, and certain other physical lesions. No attempt will be made to describe these conditions, but some of the principal ones will be mentioned. Vices of conformation are generally arrests of development. Thus there may be hare-lip, or spina bifida; the origin of each has been mentioned. So, too, epispadias and hypospadias. An imperforate anus or vagina was normal at a certain period of embryonic development, but becomes pathological by its persistence. An arrest of development may affect the upper or lower limbs, or parts of them, and thus the hand, or one or more fingers, may be absent, or the arm itself may be represented by a stump. There may be exstrophy of the bladder, hernia of the brain, etc. Internal vices of conformation may be observed, such as absence of a part or of the entire rectum, the persistence of the cloaca, incomplete formation of the recto-vaginal, or of the vesico-vaginal wall. In some instances instead of defective, there is superfluous formation. Thus, a child may have six fingers on each hand, six toes on each foot, or the female may have one or more additional mammæ. In many cases, both of deficient and of excessive formation, heredity is the most important factor.

According to Saint-Hilaire monstrosities are grave, faulty, and com-

plex deviations from the specific type, and apparent at the exterior and congenital. A simpler definition is given by Bailly. Monstrosities are those with organic defects which alter the exterior form and aspect of the fœtus so greatly as to give it an appearance very different from that usually seen in the new-born, so as to cause astonishment and disgust. Monsters may be single or double. The most frequent form of single monster with which the obstetrician meets is that in which the greater part of the cranial vault and encephalon are wanting, or the *anencephalous* monster. The *exencephalous* monstrosity has an imperfectly-formed brain, in part at least, placed outside the cranial cavity, which itself is imperfect. In the *acephalous* the head is entirely absent—"the fœtal body is then constituted of a more or less considerable mass, and in many cases of excessive development, and, besides, presents other vices of conformation as well in the members as in the principal viscera." In double monsters, the duplicity varies from the presence of a single supernumerary member to the actual union, usually at the back or thorax, of two otherwise normally developed infants.

Kormann states that double monsters result from more or less complete division of the germ into two germ layers; this is caused by an overripe condition of the ovule, and the penetration of two spermatozoids into the ovule, in frogs. It may concern the whole body of each of the twins, *Terata anakatadidyma*, which are connected only in the median line at the thorax, *Thoracopagus*, or only at the xyphoid cartilage, *Xiphopagus*, or throughout the whole length, *Prosopo-Thoracopagus*, or only at the sacrum, *Pygopagus*. In some cases there may be a cranium with two faces and one trunk, *Diprosopus*. or the heads may be completely separated, *Dicephalus*. Again, there may be four feet and a single trunk, *Dipygus*, or two trunks may be surmounted by a single head, *Syncephalus*, or the heads may be united at the top of each cranium, while the bodies are completely separate, *Kraniopagus*.

Spontaneous Amputations.—These may concern the upper or the lower limbs, more frequently, however, the latter; they are caused either by amniotic bands or by the cord encircling the member that becomes mutilated, producing a constriction which prevents the part below the constricted place receiving any blood; if the bone be cartilaginous there is no improbability in the statement that complete section may occur, but in some cases at least of spontaneous amputation the final separation of the member, after constriction of the soft parts, has resulted from a fracture. Cases of amputation cannot be confounded with those where there has been deficient development, for the amputated member has been

FIG. 104.

SPONTANEOUS INTRA-UTERINE AMPUTATION.

expelled with the fœtus from the uterus. Generally those fœtuses to whom this accident has happened are still-born.

Spontaneous Fractures.—Chaussier saw one fœtus with 43 fractures in different parts of the skeleton, and another with 113. The late Dr. Hodgen, of St. Louis, reported the case of a child which at birth had 65 fractures; he attributed them to muscular action during intra-uterine life.[1] Bailly divides spontaneous intra-uterine fractures into real, and apparent; the former may be caused by uterine action alone, or by the pressure which the fœtus undergoes in delivery, while the others result from a disturbance in ossification in which the calcareous matter is deposited in isolated points without penetrating into all the extent of the cartilage; and hence solutions of bony continuity which have been mistaken for true fractures. Fractures may be caused by external violence to the mother. Packard[2] gives cases where the broken bones were firmly united at birth, but others where no union occurred. Brinton has reported two cases of intra-uterine fracture, one of the tibia, the other of the clavicle, occurring from injuries received by the mothers.[3]

Spontaneous Luxations.—These, especially of the hip, are not, according to Kleinwächter, so very rare. Dislocations of the hip-joint, he states, occur from an abnormal position of the acetabulum, and from its congenital smallness, and are more frequent in females.

Syphilis.—Syphilitic infection of the fœtus and its influence upon the pregnancy have been previously considered, and hence the only reference here made will be to the child having syphilitic manifestations when born alive. When syphilitic manifestations are present at birth, the child has a shrivelled appearance, is under size, its cry is feeble and hoarse; characteristic snuffles are present, and an eruption of pemphigus covers the body. "If, as generally happens, the internal organs are extensively diseased, the child dies. If no disease of the internal organs be present, the child may linger for a longer time, but it generally dies in the end."[4]

Acute Infectious and Other Diseases.—The relations of the former to the fœtus have been considered in connection with their occurrence in the mother. Pleuritis, pneumonia, pulmonary tuberculosis, and peritonitis may occur in intra-uterine life. Serous accumulations may also take place in various fœtal cavities; that form which is met with most frequently is hydrocephalus, and the next is ascites; either may present a serious obstacle in labor. Hydronephrosis is sometimes found, and in the greater number of cases both kidneys are involved, the most frequent cause being imperforate urethra. Morris[5] remarks that congenital hydronephrosis may give rise to tedious and protracted labor, and even render parturition impossible until the abdomen of the child has been reduced by tapping. He also calls attention to the fact that hare-lip, club-foot, some abnormality of the anus or intestine, or some malfor-

[1] St. Louis Medical and Surgical Journal, 1882.
[2] International Encyclopædia of Surgery, vol. iv.
[3] Transactions of the American Surgical Association, vol. ii.
[4] Eustace Smith, Practical Treatise on Disease in Children.
[5] Surgical Diseases of the Kidney. London, 1885.

mation of the genital organs, have often been found in the subjects of congenital hydronephrosis.

Tumors.—In addition to the tumors caused by spina bifida, omphalocele, meningocele, or encephalocele, various other tumors, fluid or solid, may be found upon different parts of the body. Some of these are pedunculated, others attached by a broad base; some are so large as to to render parturition difficult or impossible without operative means.

Death of the Fœtus.—The chief causes of fœtal death have been presented in considering the pathology of the mother and that of the ovum.

Retention of the Embryo or Fœtus in the Womb.—When the product of conception is not expelled soon after its death, certain changes occur which will now be considered.

Liquefaction.—This may occur during the first two months at least, the embryo being dissolved so completely that no trace or only a trace of it is left. The amniotic liquor becomes thick and opaque, sometimes having a milk-like appearance like an emulsion. Important changes meanwhile occur in the fœtal appendages. If the myxomatous degeneration of the chorial villi has already begun—according to some the death of the embryo or of the fœtus is the cause of such degeneration, but according to most it is the consequence—that degeneration continues. But more frequently the formation of what has been termed a fleshy mole[1] follows. This is composed of the deciduous membranes, and the membranes of the ovum with a central cavity occupied as mentioned, of the placenta in process of formation, and of blood which is infiltrated between the chorial villi and between the membranes. The separation between the mass and the uterus being incomplete, the former is nourished, and growth of its elements continues, the clots are absorbed, or the fibrin, according to Scanzoni, becomes organized, the amniotic cavity grows smaller, and finally a nearly solid mass results. The "fleshy mole" may be retained in the uterus for some weeks, giving rise meantime to occasional attacks of uterine "pains" and hemorrhage.

Mummification.—This has been compared to the change which a fruit undergoes when kept in alcohol. The soft tissues of the fœtus become condensed, contracted, hardened, dried up, and thus it is lessened in size and presents a shrivelled appearance; its color becomes a dull gray or yellow, presenting a striking contrast with the normal color of the living fœtus. The amniotic liquor finally disap-

1 Depaul has remarked that (Dictionnaire Encyclopédique des Sciences Médicales, second series, volume ix.) "nothing is yet more obscure to-day, than the etymology of the word mole. The most natural is that which derives it from the Latin word *moles*, which signifies mass." I think that Depaul was mistaken. It seems that both Hippocrates and Aristotle applied the word Μύλη, which originally meant a mill, to "a hard formation in a woman's womb." From this word the Romans had *mola*, also primarily meaning a mill; Pliny certainly applied *mola* to such an intra-uterine formation as has been mentioned. But both μὐλη and *mola* meant secondarily the stone which was essential for grinding. Hippocrates undoubtedly had observed calcified fibroids discharged from the uterus, and it was quite natural that such a formation should be called μύλη. The application of the term to other solid masses expelled from the uterus, would obviously follow. And, therefore, the derivation of the term mole from *moles* is unnecessary, for it seems to properly originate from the Greek μύλη, the Latin *mola*.

pears, leaving as a residue an earthy, grayish sediment "similar to the deposit left by a stream after an overflow of its banks." Mummification, of course, does not occur if the membranes have been ruptured, nor is it usually seen except in a fœtus of three to four months.

Maceration.—This is the most frequent change observed after the death of the fœtus. "It differs essentially from putrefaction in this, that the decomposition is produced slowly, without the formation of gas, without odor, without the cadaveric tint, and never causing in the mother those consequence to which she is exposed by putrefaction." The fœtal surface takes a dark red hue; the cutis is detached in large pieces, especially from the hands and feet, and the abdominal walls, or in some parts it may be raised in blebs; the subcutaneous tissues have the color of lees of wine, and the consistence of currant jelly, and scattered through them are little fat masses; the serous cavities contain a dark reddish fluid; the bones are loosened from their attachments, and the body can be folded or compressed into almost any shape.

Putrefaction.—This occurs when the membranes have been ruptured, and thus air gets access; air with moisture and warmth furnish the essential conditions for putrefactive changes. Putrefaction occurs very rapidly, and McClintock,[1] referring to this fact, stated that he had seen the uterus become quite tympanitic from this cause after the accession of labor and before delivery. The abdomen of the fœtus is distended by gas, the connective tissue emphysematous, crepitating upon touch, the entire body and members greatly swelled, so that serious difficulty in delivery may be presented, and a horrible odor exhales from the fœtus. In some cases gas accumulates in the uterus, a condition known as physometra, and the organ is greatly distended and tympanitic. Generally the effect of fœtal putrefaction upon the mother is more or less grave; she has chills, fever, diarrhœa, and death may result from the infection of her system, unless the decomposing fœtus be promptly removed, and appropriate local antisepsis be employed.

When death of the fœtus occurs, expulsion usually follows in from two to fifteen days; but in some cases it is retained until the normal end of pregnancy, and in others very much beyond that time. If there be twin pregnancy, it is very common for the dead fœtus to be retained until the complete development of the living one.

Abortion.—Abortion, or miscarriage, is the expulsion of the product of conception before the time that the fœtus is viable. It has been by some divided, according to the period of intra-uterine development, into ovular, embryonic, and fœtal; the first is applied to abortion in the first three weeks, the second to that in the remaining portion of the first three months, and the third to that which occurs subsequently.

Frequency.—We have no statistics showing how frequently abortion occurs. Whitehead's[2] statistics show that 87 per cent. of women living in wedlock until after the menopause had aborted at some time in their married life. It has been estimated that the proportion of abortions to labors is 1 to 5. This probably is very much under the

[1] Note to Sydenham Society's edition of Smellie's Midwifery. [2] Abortion and Sterility.

actual proportion, for there are many abortions in the earlier weeks without women being conscious of the fact, and a still greater number occur that are purposely concealed from the knowledge of physicians. The sterility of prostitutes, as well as that observed in some of the newly married, may be attributed in many cases to early abortion.

Classification.—Abortion has been divided into spontaneous, or natural, and accidental; by the former a miscarriage occurring from obscure or latent causes is designated, and by the latter one that has an obvious cause. But this distinction is in many cases impossible to be made. A better division is into spontaneous and artificial. The latter class is divided into therapeutic and criminal; therapeutic abortion is that which is done by the physician in the interest of the mother's life or health, while criminal abortion is without this or any other justification. The term incomplete, or imperfect, is applied to those cases of abortion in which the entire ovum is not expelled. By missed abortion is meant retention of the ovum after the death of the embryo or fœtus beyond the usual time in which its expulsion occurs, that is, for more than two weeks; this delay in expulsion may be for several weeks, or even for months.

Time of Abortion.—The greater number of miscarriages occur in the first three months of pregnancy. There is an exception to this rule, however, given by those cases of criminal abortion which become subjects of judicial inquiry. Tardieu[1] has shown by statistics collected by himself and others that criminal abortion is more frequent fromthe third to the sixth month than in the first two months. The explanation of this fact is, that up to three months a woman hopes there is simply a delay in the appearance of the flow, but when this hope fails she is ready to resort to active means to end a pregnancy which has now become almost certain; on the other hand, when six months have elapsed the life of the child has become so manifest that she shrinks from its destruction—fœtal movements make successful appeal to the mother's conscience, if not to her love also, for the salvation of the new life which dwells within her womb as its sanctuary. The great majority of spontaneous abortions occur at a time corresponding with a monthly flow; Boerhaave made the proportion nine out of ten.

Causes of Abortion.—Very trifling causes may produce miscarriage in some women. La Motte has said that a misstep, raising the arms too high, a strong odor, as of musk, amber, or civet, a bad odor, as from a dead animal in the road, from a charcoal fire just kindled, or from a lamp or candle imperfectly extinguished, may end the pregnancy in some. On the other hand, the most active exercise, the severest injuries, grave surgical operations, the most cruel violences, or the use of enormous doses of irritant medicines reputed abortive, have not caused miscarriage in others.

Instances of frequently recurring abortion are not uncommon; one has been mentioned of a woman who miscarried twenty-four times at three months. These have been termed habitual abortion. But as

[1] Etude Médico-Légale sur l'Avortement.

remarked by Kleinwächter, habit is not to be regarded as a cause; it would be more rational, since habit did not begin the series, to attribute the abortion, in most cases, to the still acting original cause. Dr. Meigs attributed so-called habitual abortions to excessive irritability of the uterus; others have held that they were caused by a want of nutritive material in the uterus for its complete development, the organ growing for a time, and then the growth ceases, and abortion follows. Neither hypothesis rests upon established facts, but each indicates the incorrectness of the view that habit is its cause.

The causes of miscarriage do not, in all cases, act separately, but very frequently two or more are combined. Some simply predispose to the accident, while others are the efficient agents. In their further consideration, it is convenient to divide them into paternal, maternal, and those belonging to the ovum.

Paternal Causes.—According to Deviliers, the procreative power being distinct from that of development, the evolution of the product of conception is almost entirely under the influence of the degree of vitality of the mother. Nevertheless, the father being syphilitic, the fœtus may be infected and perish, though the mother remains healthy. It is quite possible, too, that in addition to syphilis other diseased conditions of the father, such as alcoholism and phthisis, may result in a fœtal malady which is incompatible with the continuance of pregnancy.

Maternal Causes.—These may be divided into external and internal, or those coming from without, and those acting from within. Among external causes are violent exercise, as running, dancing, jumping, riding on a hard trotting horse or over a rough road; lifting heavy weights, falls, blows upon the abdomen, compression of the body by clothing or by corsets, compression of a varicose limb, the use of the uterine sound, applications to the cervix, leeching the cervix or the vulva, and surgical operations, especially if involving the genital zone. Coition is not unseldom a cause of miscarriage. Whitehead[1] has stated that there can be little doubt that a great number of cases of uterine disease, attended with vaginal discharge, and frequently resulting in abortion, may be attributed to intemperate sexual intercourse during pregnancy. Depaul held that two-thirds of the spontaneous abortions were caused by coition, while Miquel, of Tours, makes the proportion still greater, nine out of ten.

Great altitudes are said to be a cause, and it is asserted that in some mountainous countries pregnant women descend to the valleys to escape the accident. Hot climates are thought by some to cause it. This effect has also been attributed to hot baths. Dr. Lawrence's opinion as to their injurious effect, has been stated on p. 214. This opinion is confirmed by the statement of Kormann,[2] that when used to excess they are apt to produce a miscarriage.

Among internal causes are acute infectious diseases. The explanation of their action by high temperature, by hemorrhagic endometritis, or by infection of the fœtus, has been given. Chronic infectious diseases differ in their influence upon pregnancy, phthisis comparatively

[1] Op. cit. [2] Op. cit.

seldom arresting it, while syphilis frequently does. Olshausen regards syphilis and retroflexion of the uterus as the most frequent causes of spontaneous abortion. Some of the sporadic diseases produce the same result, as has been previously mentioned; so may lead poisoning and albuminous nephritis. It is by some held that a pregnant woman working in a tobacco factory is thereby rendered liable to miscarriage. Abortion may result from violent sneezing, coughing, or vomiting; likewise from diarrhœa or dysentery. Adhesions of the uterus from former peritoneal inflammation may prevent the development of the organ, and thus make an end to the pregnancy; so, too, rigidity of its body, or relaxation of the cervix, are regarded as causes. Abdominal tumors external to the uterus may occupy so much space that there is no room for the pregnant uterus, and hence its contractions resulting in expulsion of the ovum may be evoked. Positional and structural diseases of the uterus are causes Among the former prolapse and posterior displacements are of especial significance; among the latter malignant disease, particularly of the fundus, and polypi and fibroid tumors. Strong mental emotions as fear, sorrow, joy, or anger may produce it. Whitehead and Duncan, among others, have mentioned the fact that the last pregnancy in the child-bearing period is quite liable to end in a miscarriage.

Abortion from the Use of Medicines.—It sometimes happens that abortion is caused by the use of drugs, as, for example, active cathartics, or even laxatives, or emetics. It may be that in some cases the administration of quinine has been followed by miscarriage, and while in almost all instances the event is justly attributed to the disease for which the medicine is given, yet possibly the latter, in a few, may be, from some peculiarity of constitution of the individual, the efficient agent. Nevetheless, neither this nor any other drug can be regarded as an abortifacient; there must be some tendency to miscarriage, some abnormal condition which renders the parties who thus suffer after taking any of these agents, liable to miscarry. I have known two pregnant married women take an infusion of May-apple in such large quantity as to produce violent catharsis and emesis with great prostration, yet in neither was the pregnancy interrupted.

Ploss remarks that many of the medicines used now for procuring abortion were used in old times. The Hindoo physicians chiefly employed vegetable preparations, and had one for each month of pregnancy. The ancient Jewish physicians recognized such medicines, and these are mentioned under a special name in the Talmud, but forbade their use by the pregnant, regarding abortion as a sort of infanticide. The Greeks and Romans used mentha pulegium and crocus sativus. Among other agents mentioned by Soranus are artemisia, elaterium, colycynth, turpentine, with rose or cypress oil, and emetics. The German physicians of the 16th century mention various means for causing miscarriage, as smoke from the manure of the donkey, fecal matter from the hawk and dove, sulphur and galbanum. Wine with assafœtida was given, and also myrrh, decoction of figs, hellebore, staphisagria, ox-gall, etc. Ergot was long a secret means, but was used by obstetricians in 1747.

Causes belonging to the Ovum.—Velpeau, after examining the ova from two hundred abortions which occurred under three months, found one-half were diseased. The various diseases of the decidua that have been mentioned, and its premature atrophy, are frequent causes; also placental apoplexy, and the different degenerations of the placenta. Polyhydramnios in most occasions the pregnancy to be early arrested, in consequence of the great distension of the womb resulting from the rapid and large accumulation of amniotic liquor. The uterus, too, in many cases reacts too soon in consequence of similar excessive distension in multiple pregnancy. Abnormal implantation of the placenta, commonly known as placenta prævia, frequently leads to miscarriage. The fœtus may be affected by the same disease as the mother, or suffer independently of her, and its death result in abortion. Disease of the umbilical cord, or its compression, may have a like fatal effect upon it, and thus upon the pregnancy.

Symptoms.—In some cases of abortion premonitory symptoms may be observed. These are alternate flushes of heat and chilliness, a feeling of languor or feebleness, lumbar pain, a sensation of pelvic weight, of fulness of the lower part of the abdomen, some irritability of the bladder, and possibly of the rectum also.

The characteristic symptoms are hemorrhage and painful contractions; contractions are, indeed, the efficient cause of abortion. In the first weeks it may be readily mistaken by the woman herself, especially if she has had other early miscarriages, and by the physician, for an attack of dysmenorrhœa. But the rule is, that in the latter pain precedes the flow of blood, whereas in the former the phenomena occur in the reverse order, or else they are associated. Some cases have early in their progress a gush of watery fluid slightly discolored with blood; this discharge does not necessarily indicate rupture of the ovum, and hence that miscarriage is inevitable, for it may occur from catarrhal endometritis. But no such discharge occurs either before or during menstruation. Usually the flow of blood is very much greater than that which occurs in menstruation. Further, it is possible some of the sympathetic disturbances arising from pregnancy may have appeared, and if so, this fact will assist in making a diagnosis. The final proof of the case being one of abortion, and not of difficult menstruation, would be finding the ovum in the discharge, possibly surrounded by a clot of blood. The ovum of an early abortion is generally entire, though the fact that the sac is ruptured is not a proof, as claimed by some, that it has resulted from criminal means. In some cases, occurring from the first to the second month, blood may not only be effused between the decidua and the chorion, but also penetrate the chorion and then the amnion, more or less completely filling the amniotic cavity.

If the pregnancy has advanced to seven or eight weeks, or further, but still not reached three months, the symptoms of abortion are usually quite plain. The suffering, the regular recurrence of the pains, and the marked hemorrhage, scarcely leave room for doubt. It is a labor in miniature, at least so far as it relates to the expelling organ and to the expelled product, but not in miniature in regard to

the duration of the process and the attendant suffering. The ovum is in the majority of cases expelled entire if there has been no improper interference. The chorial villi are very distinct, and, as Pajot has said, the entire external surface of the ovum is placenta. The deciduous membranes are usually discharged afterward, at least a considerable portion of these does not pass off with the ovum.

If the pregnancy has advanced to three months or beyond—that is, if the abortion be fœtal—the ovum is usually ruptured in the process, and the fœtus is expelled first, while its appendages wait a renewal of uterine activity for their discharge. In this respect the course is similar to that of labor. A delay of many hours, or even of several days, may occur in the expulsion of the fœtal appendages; and during this retention the patient is liable to attacks of hemorrage, or she may have a bloody and purulent offensive discharge.

Secondary Cervical Pregnancy.—In some instances of early abortion, the ovum is expelled from the uterine, but remains in the cervical cavity, and, it has been asserted, is nourished through an elongated portion of the serotine membrane which thus forms a pedicle. The ovum continues to grow until the limit of the expansibility of the cervical canal is reached, that is, until about the third month. The possibility of this occurrence is greater in primigravidæ. Montgomery[1] has recently reported a case of cervical pregnancy. According to Thévenot, while primary cervical pregnancy may occur, though very rarely, the secondary form does not exist; those described as such should be regarded as cases of temporarily arrested abortion; growth of the ovum in the cervical cavity in such conditions, even if the pedicle of the serotine membrane were demonstrated, is very improbable.

It happens in some cases that after severe pains, and more or less hemorrhage with dilatation, so that the finger can touch the ovum, even, too, with discharge of a fragment of decidua, as has been observed by Spiegelberg, Matthews Duncan, and others, the symptoms of miscarriage gradually cease, and the pregnancy is completed. More frequently, however, the cessation is temporary; it may last some hours, or even days, and then uterine action is renewed, and the usual result follows. In those cases of threatened abortion in the early months where the symptoms cease, but which had considerable discharge of blood, the discharge came from detachment of the ovum at its lower segment, not from detachment of the placenta; indeed such cases are usually seen before the placenta is completely formed.

In the fourth month, and on to the seventh, the course of abortion is similar to that of premature, or of mature labor, the process being however longer than in labor, because the cervical changes which precede the latter must be effected, and because the uterine muscular structure is imperfectly developed. Hemorrhage is less to be feared as the seventh month is approached; the uterine decidua is more readily cast off in late than in early abortions; before the formation of the placenta the hemorrhage comes from the entire internal surface of the uterus, but afterward only from the place of placental attach-

[1] American Journal of Obstetrics, 1885.

ment. Minati[1] states that the pains suffered in abortion occurring before three months are referred to the sacrum, and pass on either side toward the pubis; but when pregnancy has advanced to the fourth, fifth, or sixth month, they pass from the sacrum to the pubes, to the hypogastrium, and towards the umbilical region. Very little discharge follows an abortion in the early months if it be complete; but if a portion of the ovum be retained, the hemorrhage may be great, and there is also in many cases a very offensive flow. Milk is usually secreted after miscarriage, in some instances even when that occurs quite early in pregnancy.

Prognosis.—If the abortion be inevitable, of course the fœtus dies, or is already dead, and the practitioner is concerned with the interests of the mother alone. The chief immediate dangers are hemorrhage or septicæmia, which may be general, or be limited to a local pelvic inflammation. Tetanus has occasionally followed. Putrid decomposition of fragments left in the uterus, according to Kleinwächter, is less frequent than generally believed, because of the difficult entrance of air, and because manual intervention is less frequently resorted to than in birth at the normal time.

The fatality following criminal abortion is very great. Hippocrates said that abortion was much more dangerous than labor, because the product of conception could not be destroyed except by violent means; but this remark is especially applicable to the criminal character. Tardieu states that in 116 of this class, in which the termination was certainly known, death occurred more or less promptly in 60. He refers to cases of sudden death which may be caused by embolism, by syncope either from excessive pain, or from the moral shock created by the consciousness of crime. Other causes which conduce to the fatality of criminal abortion are the secrecy with which the operation is done; usually the unhappy victim goes to the house of the abortionist, and he or she, for women are alike engaged in the wicked work, endeavors to puncture or detach the membranes, possibly wounding the uterus in these efforts, in many instances "made by an ignorant or brutal hand, or one that trembles with conscious guilt." After the operation the subject walks or rides probably a long distance to her home, and there, in order to conceal all knowledge of her condition, engages in her usual avocation or work, until grave symptoms compel her to rest, and possibly to send for a physician.

The remote dangers of abortion are chronic parenchymatous metritis, very often spoken of as sub-involution, and positional disorder of the uterus; a portion of the placenta may remain, and be converted into a placental polypus, or hypertrophy of undetached decidua may occur, and either be the cause of uterine hemorrhage. These dangers may be prevented in most cases by proper care during and after abortion. Unfortunately too many women look upon miscarriage as a trivial matter, and do not take the rest after it that they ought.

Treatment.—The treatment may be considered under three heads, prophylaxis, that required in threatened or commencing abortion, and that of inevitable abortion.

[1] Ostetricia Minore. Milan, 1881.

Prophylactic Treatment.—This includes a recognition of the causes of miscarriage in individual cases, and their removal. It is not necessary to repeat the etiology of this accident, nor the treatment required in different cases. In habitually recurring abortion the probability is that syphilis, or uterine retroflexion, or an endometritis is the cause. The late Professor Henry Miller, of the University of Louisville, who was one of the first of American physicians to teach and to practise the local treatment of uterine diseases, regarded inflammation of the lining membrane of the uterus as one of the most frequent causes of miscarriage, and urged the importance of properly treating the former in order to prevent the latter. When a woman who has previously aborted becomes pregnant, she should be advised to avoid all exercise at the time in the new pregnancy corresponding with that in the former when abortion occurred. So, too, rest at the times corresponding with "monthly periods" should be enjoined. Sexual intercourse ought to be forbidden.

The late Sir James Y. Simpson advised the potassic chlorate, ten to twenty grains three times a day, as a preventative; he gave it for placental disease, and also as a means of arterializing the blood. Certainly, the theory upon which it is administered is erroneous, and the remedy is of doubtful value. A preparation from the bark of the black haw (*Viburnum prunifolium*) was recommended by Phares, in 1866, as useful in preventing miscarriage; since then it has been occasionally endorsed for this purpose by others; recently Wilson and Campbell[1] have recommended it very highly, sustaining the claims previously made for this medicine, that it is a tonic and uterine sedative; pills of two to four grains of the solid extract were given three or four times a day; Wood[2] states that we have no exact knowledge of the action of the remedy, and its value must be considered at present apocryphal. The dose of the fluid extract, the only preparation of viburnum which is officinal, is from half a teaspoonful to one or two teaspoonfuls, three times a day. In most cases if four months have passed without abortion occurring, that is, if a previous one were before this time, the probability is that the pregnancy will not be disturbed, and the patient may gradually resume a moderately active life.

Treatment of beginning Abortion.—Here the characteristic symptoms, to wit, hemorrhage and uterine contractions are present; under only three conditions is the abortion inevitable, the first is the death of the embryo or fœtus, the second, detachment of a large portion of the ovum, and the third, rupture of the ovum. But it is in exceptional cases the physician can know at the beginning that any one of these conditions is present, and therefore his duty is to endeavor to arrest the miscarriage. The patient should at once lie down, her clothing being quite loose, the bed moderately hard, and she should be only lightly covered; her drinks should be cold—iced lemonade is very commonly given. Twenty drops of laudanum with half a teacup of warm water should be at once injected into the rectum, or an equivalent amount of opium in the form of a suppository

[1] British Medical Journal, 1886.

[2] U. S. Dispensatory, 1883.

may be used. The purpose sought to be accomplished by the opiate is to lessen the irritability and arrest the contractions of the uterus; it is claimed by some that the pregnant woman bears this remedy much better than when not pregnant. If the contractions have not decidedly abated in one hour, the injection or suppository is repeated, and again if necessary at the end of the second hour, and still again at the end of the third hour. If the patient is very nervous and restless, twenty to thirty grains of chloral may be added to one of the opiate injections, and then the vehicle should be, not warm water, but the yelk of an egg and some warm milk. When opiates are given freely, it is quite possible that retention of urine will follow, and if this is the case the catheter should be used as needed, twice or thrice in the twenty-four hours; the employment of the instrument is preferable to allowing the patient to sit up to urinate. The opium may be continued from day to day as long as there is any hope of arresting the abortion. Meantime, once in two days the bowels should be opened by a warm-water injection, or by a mild laxative. Supposing the pain and hemorrhage to cease, it is better for the patient to remain in bed for three or four days after this cessation; when she gets up she should only gradually resume her usual habits of life, even then as an experiment, and prepared to return to bed at the first recurrence of the former symptoms. Unfortunately, in the majority of cases, the pains and hemorrhage do not cease, or having stopped they return, and the abortion is apparently inevitable, or the flow may be so great that its arrest is necessary without regard to the continuance of the pregnancy.

Treatment of Inevitable Abortion.—Two indications are presented—stop the bleeding and empty the uterus. The application of cloths, wrung out of ice-water, to the vulva, to the lower part of the abdomen, and to the upper part of the thighs, has been recommended; but apart from the uncertainty of this use of cold, such applications may chill the patient, and will make her uncomfortable, and may cause, if there be liability to either, an attack of bronchitis or of rheumatism. The most valuable, the safest, and most certain means of arresting the hemorrhage is the tampon. Of course the tampon can be best applied by using Sims's speculum, but this is not essential unless possibly when the hemorrhage is so great that the entire vagina must be tamponed. The following method may be satisfactorily used in almost all cases: The vagina should be washed out with an antiseptic injection, and the bladder emptied; let the patient lie on her back with flexed legs and thighs; the practitioner having provided a number of balls of absorbent cotton, about the size of a hulled walnut, and some iodoform in powder, or a solution of carbolic acid, now separates the labia with two fingers of one hand, then by means of an ordinary dressing forceps in the other hand, carries one and then another of the cotton balls up into the vaginal vault, firmly pressing them around the cervix; the balls first introduced should be covered with iodoform or dipped in the carbolized water. After filling the vaginal vault with the cotton, another layer of balls is firmly placed beneath the first, and still one or two beneath that, until at least the upper third of the vagina is completely filled, and the os uteri covered over. The use of an astringent solution,

such as one of the salts of iron, is unnecessary, for by no possibility can one drop of the solution come in contact with the bleeding surface, and needless irritation, even inflammation and sloughing of the vagina may occur if the solution be concentrated.

In grave hemorrhage it may be necessary to tampon the entire vagina, and to secure the packing by a T bandage. The tampon is a perfect safeguard against hemorrhage, but it must be of suitable material and properly applied; let no practitioner in this or any other case of uterine hemorrhage delude himself by trusting a tampon of sponge. The advantages of the tampon in abortion are, not only in the arrest of external hemorrhage, but its pressure evokes uterine contractions, and the small quantity of blood escaping from the detachment of the ovum is now shut up in the womb, and passes between the ovum and the uterine wall, completing the separation, and thus facilitating the entire discharge of the ovum. The tampon may be left in place twelve or twenty-four hours, remembering that antiseptic precautions have been taken. Upon its removal the ovum will in many cases be found in the upper part of the vagina, or it may have entered the cervical canal, and so completely fill it that a repetition of the tampon is unnecessary; in the latter case firm compression of the uterus may complete the expulsion of the ovum; even before the descent into the canal delivery by expression may be successful.

The general practice is to give ergot when attended with much hemorrhage; but if the cervical canal be undilated, it is claimed by some that the medicine contributes quite as much to the imprisonment as to the expulsion of the ovum. This objection is completely removed if the tampon be used when ergot is administered. Ergot and the tampon are remedies that act admirably when associated in these cases. The practitioner in cases of miscarriage in the first three months should be especially careful not to rupture the ovum, for if the amniotic sac be opened there is great danger of its being incomplete. Of course if hemorrhage persists or returns, the abortion not yet having taken place, the tampon is to be repeated, and with the repetition ergot may also be used.

While in the great majority of cases under this treatment the ovum is expelled entire, in some the embryo or the fœtus is discharged, but the appendages retained; or the case may be one in which the abortion was begun by perforation of the membranes. If the pregnancy has continued as long as four months, usually expression will cause the expulsion of the placenta and membranes; if necessary this expulsion may be facilitated by digital or other dilatation of the os uteri. These cases rarely present serious difficulties, though there may be great delay in completely emptying the womb. But when a miscarriage occurs in the period from seven to ten weeks, and immediately after the expulsion of the embryo the cervical canal closes, what practice is to be pursued? Some insist upon immediately emptying the uterus by means, if necessary, of instruments, either forceps, curettes, or Simon's spoon. Certainly when incomplete it carries with it serious dangers, but hasty interference is not free from peril; the appendages are retained either because still attached to the uterus, or because of the

obstacle presented by the narrowed cervix. If attachment prevents their discharge, they are a living part of the uterus, and tearing them away in itself is a traumatism, while rude efforts in this process may inflict additional traumatism, and as fragments are almost inevitably left behind, the detachment is incomplete; moreover, their presence in the uterus may for a time give rise to no symptoms.[1] But, on the other hand, if partial or complete detachment has occurred there will be hemorrhage, or if retention is permitted for a day or two in addition to the hemorrhage, there may be an offensive discharge. Now the indications for active interference are unequivocal, and delay is perilous. In these cases gradual dilatation of the os may be effected by tupelo tents or a rapid dilatation by Hegar's hard-rubber dilators, and this is the preferable plan, the patient being anæsthetized if thought best. After the dilatation the uterine cavity is disinfected by washing it out with carbolized warm water, and one or two fingers coated with an antiseptic ointment or dipped in an antiseptic solution are passed into the uterine cavity, while the other hand upon the hypogastrium fixes the uterus, and presses it down upon the internal fingers; or, as advised by Dr. Alexander R. Simpson, the uterus is drawn down to the mouth of the vulva by the vulsellum, and then one or two fingers introduced. In either case the membranes are detached by the fingers and brought down to the os; in some cases the finger and thumb may be used like a crab's claw, as Mauriceau expressed it, to seize them and draw them out.

But if digital detachment fails to remove the retained remains of the ovum, I have found the following an excellent plan in cases of early incomplete abortion. The practitioner should have at hand a basin of warm carbolized water, Churchill's tincture of iodine, Emmet's curette forceps, a uterine tenaculum, one or more applicators, a uterine probe, absorbent cotton, and a bivalve speculum, Neugebauer's answers admirably. The patient now has her hips brought to the edge of the bed, and the thighs and legs strongly flexed; after the introduction of the speculum and exposure of the os, the tenaculum is inserted into the anterior lip from below and firmly held, so as to fix the womb, and also used to straighten any flexion that may be present; next the uterine probe is introduced to ascertain the size and direction of the uterine cavity, after which the blades of the curette forceps, first being dipped in the carbolized water, are passed into the uterus, then opened, the ends pushed on until touching the uterine wall, when they are firmly closed and withdrawn; upon withdrawal they will be found to contain fragments of membranes which may be removed by opening them and moving them to and fro in the carbolized water; the process

[1] Charles says we do not advise immediate efforts for the removal of the after-birth in abortions before four months, while after this period we recommend acting as soon as possible in the artificial delivery as after labor at term. The conditions are different. 1. The danger from retention is much less. 2. The introduction of the hand is impossible because of the narrowness of the cervical canal, and the smallness of the uterine cavity. 3. The dilatation of the orifice and the introduction of instruments designed to extract the placenta are dangerous, difficult, and painful; these instruments act blindly, contuse, lacerate the uterine walls, and rarely succeed in removing all the secundines, but almost always cause metritis. In a word, the danger from retention is much less than that of extraction.—*Journal d'Accouchements*, June, 1886.

is repeated, and all parts of the uterine cavity, especially the vicinity of the entrance of the oviducts thoroughly explored, and membranes detached and removed. After completing the removal of membranes, or placental fragments, the uterine cavity is swabbed out with the iodine solution; iodine is both an excellent antiseptic and uterine hæmostatic. Ten grains of quinine may be given, as it possibly tends to promote uterine retraction, and may hinder septicæmia.

Doubtless some will think that the practice advised in incomplete abortion of the earlier weeks, when there is closure of the cervical canal after the expulsion of the embryo or fœtus, and no symptoms demand interference, too conservative. But I can fully adopt the words of that wise obstetrician, the late Dr. Churchill, "Longer experience has made me less fearful of leaving these cases to nature, and more unwilling to interfere hastily." The probability is, that they will end within a few days by the spontaneous expulsion of the uterine contents; meantime the practitioner carefully watches the case, directs antiseptic vaginal injection twice a day, and is ready to meet any dangerous symptom and to assist nature's process.

It is but just that the advice of those who pursue a somewhat different treatment should be fairly presented, and then the practitioner can wisely select according to the indications in a given case. The late Angus Macdonald said:[1] "I consider a patient is put to greater danger from a portion of the membranes being left in the uterus, to become organized there and a source of persistent menorrhagia, than she is likely to suffer from the manipulations necessary to secure complete removal of every part of the ovum in a case of miscarriage." But the hypothesis of spontaneous expulsion has a larger foundation in facts than the retention and "organization of a portion of the membranes," while the difficulty in removing "every part of the ovum" has been referred to. Mundé asserts[2] that "the future safety of the patient demands that the secundines should be at once removed after the expulsion of the fœtus, in every case in which such removal can be accomplished without force sufficient to injure the woman." Both Macdonald and Mundé advised the curette, if the finger failed; as most others, too, they direct that the uterus should be washed out after the operation with warm carbolized water. Dr. Mundé's qualification, "without force sufficient to injure the woman," should be borne in mind by the operator; it is undoubtedly wise advice, though the determination of the question must be left to the judgment of the individual as to the amount of force that may be safely used. Priestley has said that he "should not hesitate to remove the chorion in the second month before the placenta is properly constructed, if any urgent symptoms were present." Certainly, one must always pursue this course if "urgent symptoms" are present. Priestley farther directed waiting six hours after the delivery of the fœtus, for the expulsion of the placenta, before resorting to manual delivery. Guéniot, who stands almost alone among French authorities in the advocacy of early intervention in case of incomplete abortion, gives the following rules as to the time the practitioner should wait: Two days in abortions of the first two months; twenty-four hours in those of the third or fourth month; twelve hours for the fifth month, and six hours for the sixth. He thus makes a time-card for nature,

[1] Transactions of the Edinburgh Obstetrical Society, vol v.
[2] American Journal of Obstetrics, 1883.

and denies her right to action if she does not meet the arbitrary requirements of the schedule! In abortions of the later months the time given for delay is too long, for in almost all these cases the placenta and membranes can be removed by expression, and there is no necessity for introducing fingers or hand into the uterus. Those who are in haste to interfere immediately after the expulsion of fœtus or embryo, may in some cases cause a new abortion, for it may have been a multiple pregnancy, and the remaining ovum might be retained until the fœtus was perfectly developed but for this interference. Pajot has pleasantly remarked, in referring to the treatment pursued by certain German authorities in incomplete abortion—that is, the use of the curette, or Simon's spoon, and subsequent applications to the interior of the uterus of carbolic acid or perchloride of iron—that German wombs must be very complaisant in order to endure it.

After-Treatment.—The patient should remain in bed at least a week after a miscarriage, for many a woman becomes a permanent invalid from neglect of proper care at this time.

The indication in missed abortion is to empty the uterus. In some cases, as in one reported by Matthews Duncan, the introduction of a bougie will be sufficient to excite the uterine contractions; in others it may be necessary to dilate the os uteri with tupelo, or with Hegar's dilators.

In concluding the subject, a single word upon criminal abortion. The temptations to this crime probably come to every physician. He will be appealed to by the unfortunate victim of man's passion and perfidy to save her and her family from disgrace, and his sympathies will unite with the teaching of some utilitarian theories of morals to stifle the voice of conscience; family friendship will be plead by the married woman who does not wish to have any more children; or, finally, the baser motive of avarice will be invoked, and he may be promised a far more liberal sum than led Judas to be chief contributor to the crime of the ages. But he must turn a deaf ear to all these appeals. "Heart's blood weighs too heavily," and let him beware of violating both human and Divine law, no matter how great the temptation.

CHAPTER XII.

ECTOPIC DEVELOPMENT OF THE OVUM, AND OF THE PLACENTA—PREMATURE DETACHMENT OF THE NORMALLY SITUATED PLACENTA.

THE normal cavity of the body of the uterus is the place in which the development of the ovum should occur. But if this development be in the cervical canal, or outside of the uterus, or in the rudimentary horn of a one-horned or two-horned uterus, the ovum is out of place, the gestation is ectopic. Normally, too, the placenta is implanted in the upper portion of the womb; but if this implantation be in the lower segment of the womb, the placenta is out of place, there is ectopic development.

Ectopic Gestation—1. *Primitive Cervical Pregnancy.*—This occurs when the ovum, instead of being arrested in the uterine, passes into the cervical cavity and is there for a time developed. A case of this variety of pregnancy was described by Chavanne,[1] in 1862, and three were reported by Pajusco,[2] in 1880. It is very rare, and abortion in the first two or three months is the necessary consequence.

2. *Extra-Uterine Pregnancy.*—In this the ovum is developed neither in the uterine, nor in the cervical cavity, but external to the uterus. There are no statistics showing the relative frequency of extra-uterine compared with intra-uterine pregnancy; certainly, however, the former would seem to occur very seldom, for Bandl[3] states "that out of 60,000 gynecological and obstetrical cases, received during seven years at the cliniques of Carl Braun and Späth, in Vienna, there were only five cases." Nevertheless, as stated by Alexander R. Simpson,[4] many cases of hæmatocele associated with one or two months' amenorrhœa are really extra-uterine fœtations, so that it is probable the accident is more frequent than the statistics just quoted indicated.

Multiparæ are more exposed to the accident than those who are for the first time pregnant; for, as Naegele has said, tubal or other anomalies, which predispose to the accident, are often the result of an inflammation occurring after labor. Old primiparæ, too, according to the late Sir James Simpson, are more liable to the accident.

Astruc thought that unmarried women had a greater liability to the accident than the married, because of some profound mental impression, as fear or indignation, during sexual intercourse. According to Velpeau, who stated that this was rather a plausible hypothesis, a case of Baudelocque's, another of Lallemand's, and a third of Bellivier's, seemed to sustain it; in

[1] Gazette des Hôp.
[2] Mémoire de Thévenot.
[3] Manual of Gynecology: Hart and Barbour.
[4] Transactions of the Edinburgh Obstetrical Society, vol. ix.

two of these subjects a sudden noise made them fear that they would be surprised *en flagrant délit*. Playfair seems to attach some importance to "fright, either during coition or a few days afterward,"[1] as a possible cause. But as it is now known that an interval of several hours must, or even of days may, intervene between insemination and impregnation, one can hardly go as far as Velpeau, and call Astruc's hypothesis rather plausible.

The chief varieties of extra-uterine gestation are ovarian, tubal, and abdominal. The first of these is the rarest. Spiegelberg found only nine, his own making the tenth. Kleinwächter,[2] 1881, stated that two had been published since, so that the entire number was twelve. Leopold,[3] in 1882, reported a case which, according to him, was the fourteenth where the anatomo-pathologic proof of the ovarian pregnancy was established. To the fourteen may be added one recently reported by Samson,[4] so that now the entire number is fifteen.

Ovarian pregnancy results, according to some, from a spermatozoid penetrating the thin wall of the ovisac; this supposition is generally regarded as very improbable. The explanation commonly received is that the ovisac ruptures, but the ovule fails to escape, either because the rent is so small, or because it is remote from the former; the spermatozoid enters through the opening, and conception follows. The rent may now close, or remain open; in the first case the ovisac furnishes the external covering of the developing ovum; in the second, while the placenta is attached within the ovisac, the ovum soon grows out of it through the rent that continued patent.

In tubal pregnancy the ovum may be arrested at the entrance of the oviduct, and in its development become attached to the ovary as well as to the tube, and the pregnancy is that variety called tubo-ovarian. Another variety is known as tubo-abdominal. The arrest of the impregnated ovule may occur in that portion of the oviduct which passes through the uterine wall, and the pregnancy is then as tubo-uterine or interstitial. That which is called simple tubal pregnancy occurs when the ovum occupies an intermediate point between the abdominal and the uterine end of the oviduct. In tubo-ovarian pregnancy the external covering of the ovum is formed partly by the tube, partly by the ovary, and finally by an inflammatory exudate which connects these. In interstitial pregnancy the covering is composed of the walls of the oviduct and of uterine tissue (Fig. 106). In tubal pregnancy the covering is composed solely of the walls of the oviduct.

The failure of the ovum to reach the uterine cavity in tubal pregnancy may be caused by external compression of the oviduct from tumors, or by pseudo-membranous bands, causing narrowing of its canal, or a similar result may be consequent upon a sharp flexion of the tube; the tube may be obstructed by a polypus, or by mucous membrane swollen from inflammation; possibly, in consequence of previous inflammation, the ciliated epithelium may have suffered such injury they are no longer active in transferring the ovum; in case of multiple pregnancy, and such pregnancies are, according to the

[1] System of Midwifery.
[2] Op. cit.
[3] Archiv für Gynäkol., 1882.
[4] Allg. Wien. Med. Zeit., 1885.

statistics of Parry and others, very frequent relatively, one ovum may be in the way of the passing of the other to the uterus, and the former is developed in the tube, the latter in the uterine cavity. Browne[1] has

FIG. 105.

TUBO-UTERINE; INTERSTITIAL OR MURAL GESTATION. *a*. Cavity of uterus clothed with decidua. *b*. Broad ligament. *c*. Tubo-uterine sac which contained embryo. *d, d*. Thicker part of cyst-walls. *e*. Placenta.

given a table of twenty-four cases of twin pregnancy in which one of the fœtuses was within, the other without the uterine cavity; fourteen of the mothers died.

In some instances the oviduct may be sufficiently pervious for spermatozoids, but not for the ovum; but in others it is completely closed in some part of its course, and then there must have been either transmigration of the ovum, or else transmigration of spermatozoids; in the first case the impregnated ovule came from the opposite ovary, and in the second the spermatozoids came through the opposite tube, then made their way across to the ovary corresponding with the impervious duct.

In some cases of tubal gestation early rupture occurs at the lower part of the oviduct, so that the ovum passes between the two peritoneal layers of the broad ligament, and continues its development in this new position; the pregnancy is then extra-peritoneal.

Abdominal pregnancy may be primary, though some deny this variety, or secondary, that is, the pregnancy was first, for example, tubal or ovarian, and rupture of the inclosing walls occurring, the embryo or the entire ovum escapes into the abdominal cavity, and develop-

[1] Transactions of the American Gynecological Society, vol. vi.

ment continues. Kleinwächter gives the following explanations of the occurrence of abdominal pregnancy:—

1. The ovisac may rupture at a point so far from the pavilion that the current caused by the movement of the cilia cannot carry the ovule into the oviduct. 2. A temporary abnormal position or movement of the abdominal organs may obstruct the passage of the ovum. 3. The end of the tube may be completely closed in consequence of former inflammation, and the ovule be impregnated by semen coming through the other tube. 4. The tubal orifice may be so narrow that while permitting spermatozoids to pass, the ovule enlarged by impregnation cannot pass. 5. The oviduct may have lost its cilia from disease, and the current fail so that the ovule is not carried to the oviduct. 6. Old exudations or pseudo-membranes may either obstruct the orifice of the tube, or be in the way of the ovule reaching the orifice. 7. Abdominal pregnancy may occur when both oviducts are in normal condition. The ovule impregnated at one oviduct may pass out into the abdominal cavity, and then across to the other oviduct, but the latter will not admit it because meantime the ovum has become too large.

Two remarkable cases of abdominal pregnancy have been seen by Lecluyse and by Koeberlé. In that of the former the ovum escaped from the uterus through an opening which remained after a Cæsarean operation, performed several years before, into the abdominal cavity; in that of the latter, the uterus had been amputated two years before for fibroid tumor, but a fistula was present in the cicatrix of the cervix, and spermatozoids passing through it into the abdominal cavity, pregnancy resulted.

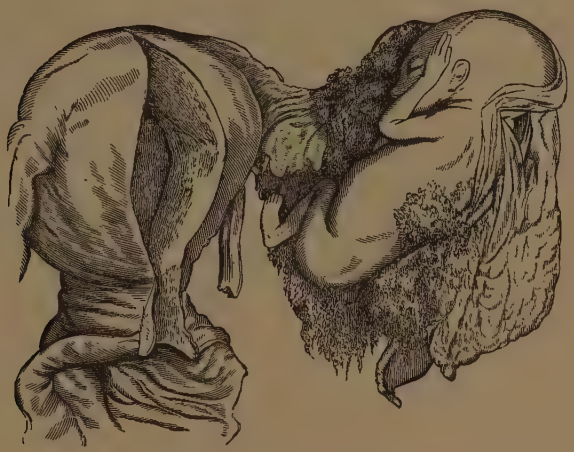
In abdominal pregnancy (Fig. 106) the developing ovum causes irritation of the adjacent parts, and a cyst is formed of pseudo-membranes. "In rare cases the cyst atrophies, or is not formed, and the ovum is free in the abdominal cavity; such cases have been seen by Lecluyse, Matecky, Schreyer, and others." According to Kleinwächter, when a sac is formed, it usually contains some muscular elements derived probably from the muscles of the subserous layer of the pelvis. The placenta has been found attached to the uterus, to the bladder, or to the ovary; "Sivard[1] has seen it attached to the mesentery and colon of the left side; Courtail to the omentum and stomach; Clarke to the kidneys and intestines; Tilt to a great part of the mesentery, mesocolon, portions of the small intestines, and to the two or three superior lumbar vertebræ; Baldwin, Wilson, and Koeberlé to the anterior abdominal wall in the line of incision made either at the post-mortem examination, or during an operation for gastrotomy." There is no uniform rule as to the size, form, and thickness of the placenta in the abdominal variety of extra-uterine pregnancy, nor in either of the other varieties.

Most authorities state that tubal is more frequent than abdominal pregnancy; according to Hecker, however, the latter is the more frequent, and the statistics of Cohnstein and of Smet confirm this statement; Kormann's view is the same.

[1] Parry on Extra-Uterine Pregnancy.

Pregnancy in the Rudimentary Horn of a Uterus Unicornis or Bicornis.—Such rudimentary horn represents the tube quite as much as it

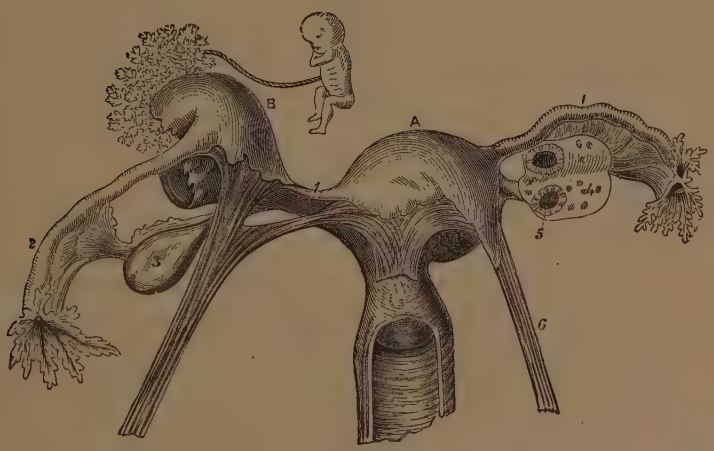
FIG. 106.



UTERUS AND FŒTUS IN A CASE OF ABDOMINAL PREGNANCY.

does the uterus; it is a portion of the tube which in embryonic development has failed to unite with a corresponding structure of the opposite side for the formation of the uterus. Pregnancy in such horn is

FIG. 107.



GESTATION IN A RUDIMENTARY HORN OF UTERUS.—*A.* Developed right horn. *B.* Rudimentary horn, with a rent through which the embryo had escaped. 1. Right Fallopian tube. 2. Left Fallopian tube. 3. Left ovary. 4, 5. Right ovary and corpus luteum. 6. Round ligament.

in close clinical and anatomical relation with tubal pregnancy. The placenta is more perfectly formed than in other varieties of ectopic gestation (Fig. 107).

Results of Extra-Uterine Pregnancy.—These abnormal pregnancies always have abnormal terminations, but the terminations are very different. In very rare instances the ovum may pass into the uterine cavity, and be expelled from it as in spontaneous abortion. But this transfer of the ovum is only possible in tubo-uterine pregnancy, and is altogether an exceptional occurrence even then. Puech,[1] writing in 1879, stated that expulsion of the fœtus *per vias naturales* has been observed only once or twice; the remark was made in connection with an American case reported in 1878 of extra-uterine pregnancy, where the use of the galvanic current was followed by such expulsion, and he suggested that the current caused a uterine abortion. But in the very case referred to the diagnosis was made by three physicians of known ability, large experience, and great eminence, and the fact of this variety of extra-uterine fœtation must be admitted unless one is as sceptical as Mr. Tait.[2] Moreover the case of Maschka[3] has proved by post-mortem examination that the cyst in interstitial pregnancy may rupture into the uterus. A woman, 29 years of age, died suddenly. Criminal abortion being suspected, a judicial autopsy was made. An interstitial pregnancy with rupture into the uterus was found; the body of the fœtus had passed by this opening and been removed, but the head was torn from the trunk, and remained in the sac.

Rupture of the fœtal cyst is a frequent result in some varieties, and in many instances is followed by a rapidly mortal hemorrhage. In the 500 cases collected by Parry rupture occurred in 174 or in 34.8 per. cent. Chayé[4] briefly narrates the post-mortem appearances found in the case of a celebrated actress, whose sudden death a few years ago while visiting Paris created great general interest; Professor Brouardel's examination showed that death was caused by rupture of the cyst of a tubal pregnancy, the pregnancy having lasted one and a half to two months. Maygrier[5] gives a table of 56 cases of rupture followed by death, and in only 9 was the fatal result immediate; in the others the time varied from some hours to several days, showing as he suggests not only caution as to prognosis, but also furnishing opportunity for prompt and energetic intervention.

The time when rupture occurs varies, it may be a few weeks or some months; Rokitansky found in one case that rupture occurred at two weeks. Rupture occurs earliest in tubo-uterine pregnancies, and, according to Hecker's statistics including twenty-six cases, death followed in all. If the pregnancy be in the rudimentary horn of the uterus, rupture usually takes place from the third to the sixth month, and is followed by a fatal termination. In purely tubal pregnancies rupture in most cases occurs within two months; in a very few cases pregnancy has continued until term. Ovarian pregnancy lasts a little longer, the majority of cases passing the third month, but those[6] reaching the seventh, the eighth, and the ninth month are almost as exceptional as

[1] Annales de Gynecologie, tome xii. [2] Medical News, August 14, 1886.
[3] Wien med. Wochenschrift, 1885.
[4] Signes et Diagnostic de la Grossesse Extra-Utérine.
[5] Terminasons et Traitement de la Grossesse Extra-Utérine.
[6] Charpentier.

tubal pregnancies passing the fifth. Abdominal pregnancies last the longest; in many the fœtus develops during nine months, then dies, and it may be retained for many months, or even many years; in one instance the pregnancy lasted fifty-four years; a still longer retention is given below.

When rupture of the fœtal cyst occurs the immediate danger, as has been pointed out, is hemorrhage, and if the patient does not die from this, subsequent peritoneal inflammation may lead to a fatal result.

The death of the embryo or fœtus, which is a favorable event, in extra-uterine pregnancy is followed by changes similar to those which occur after death in intra-uterine pregnancy; but in addition to these changes the fœtus may be converted into adipocire, or into a lithopædion;[1] the formation of a lithopædion has been observed in pregnancy in a rudimentary uterine horn, the fœtus dying at five months. The most widely known of the last is the lithopædion of Leinzell, which was found in one of the tubes upon post-mortem of a woman ninety-two years old, who had carried it forty-six years. In August, 1883, Sappey presented to the Paris Academy of Sciences the membranes and fœtus which had been retained fifty-six years; calcareous incrustations were limited to the wall of the cyst, but the fœtus was in a natural attitude, and the skin, superficial organs, and those of the cavities, the muscles, and in fact all parts of the body preserved their consistence, their suppleness, and their normal color.

Inflammation and suppuration may occur in the fœtal cyst, ending in the discharge of the fœtus by the abdominal walls, by the bladder, the vagina, or the rectum. According to Mattei, the first is the most frequent; according to Parry, the last. In one instance the cyst communicated with the stomach; it was reported by Darby: "the cavity which contained the child had opened through the abdominal wall; when Dr. Darby enlarged the orifice and extracted the fœtus, immediately after the entire contents of the stomach emptied themselves into the cavity of cyst through a ragged, jagged opening, two inches in width."

Symptoms and Diagnosis.—The symptoms are, as remarked by Kleinwächter, in part physiological and in part pathological. Menstruation is suppressed, the uterus enlarges, the breasts are affected as in normal pregnancy, there is also the same gastric disturbance, and

[1] Lithopædion, literally a stone child, is a name given to the fœtus when calcification has occurred. Barnes states that this change is limited to the membranes and sac, the shell thus formed preserving the fœtal structures but little changed. But this is only one of three forms. Kuchenmeister states (Archiv für Gynäkol., 1881) that the fœtus falling into the abdominal cavity, in consequence of rupture of the cyst, is mummified, and by degrees covered by a calcareous layer deposited immediately beneath the epidermis; this is a true lithopædion, and it is the second form. The third form is when an incrustation involves both the membranes and the fœtus. Sarraute (Archives de Tocologie, March, 1885) in a contribution to the microscopic study of lithopædions, states that most frequently all the cavities are found filled with calcareous salts, or salts derived from fat; the cartilages and bony cavities and the vertebræ are infiltrated with calcareous masses.

"The oldest known case of lithopædion is that reported by Sens, in 1582; it was carried twenty-eight years. This case inspired Rousset to make a curious poem, in which he presented the following questions: *cur nasci potuerit? cur per vigenti octo annos in utero retentus non putruerit? cur in lapidem obduruerit?*"—Maygrier.

pigmentation occurs. Some cases are quoted by Chayé,[1] in which upon post-mortem examination the uterus was not enlarged, but such instances are quite exceptional. Its enlargement is relatively more marked in the first months; it also is different in the different forms of extra-uterine pregnancy, thus it is least in abdominal, greatest in tubal, especially in that variety of this pregnancy called tubo-uterine. Kleinwächter mentions the fact, that in consequence of the fœtus being nearer the abdominal surface, the fœtal heart-sounds and the uterine souffle are heard sooner than usual. It is questionable whether the souffle synchronous with the mother's pulse heard in extra-uterine pregnancy can be designated as uterine; Parry speaks of it as "placental."

In rare instances an extra-uterine gestation gives rise to no pathological symptoms. But in the great majority there are attacks of very severe pain in the lower part of the abdomen; these attacks seldom occur in the first month, but subsequent to it, from the second month on. Parry describes this pain as exceedingly violent; the patient cannot stand erect, nor lie with her lower limbs extended; the surface may become pale and cool, covered with a cold, clammy perspiration, the pulse small and thread-like; there may be vomiting, and the suffering so great as sometimes to cause syncope. Probably these pains are not to be attributed to a single cause, but they may result from a local peritonitis, from contractions of the uterus, or from dragging or tearing of some of the adhesions which have formed between the cyst and adjacent parts or organs. The proof that in some instances the pain arises from uterine contraction is that it is attended with discharge of blood or fragments of decidua. In most cases after a suppression of the menstrual flow for six or eight weeks, there are irregular discharges of blood from the uterus; not infrequently the blood is very dark, and sometimes in clots.

If it be increased in size, as it is in almost all cases of extra-uterine pregnancy, that increase does not correspond with the supposed duration of the pregnancy; moreover, its form is not that which occurs in normal pregnancy, but the organ instead of being rounded and fuller at the upper part, is flattened. Depaul regarded this characteristic as very important in contributing to a diagnosis. Bi-manual examination will readily enable the obstetrician to ascertain the form and size of the womb. The shape of the abdomen is not the same in the early months of extra-uterine as it is in normal pregnancy, but broader at the lower part in the former than in the latter. By two months, or in the third, a tumor will be seen and can be felt above the right or left groin, this tumor being formed by the gestation cyst, while the enlarged uterus is usually at its inner side; bi-manual examination will prove the tumor is independent of the uterus, and that its consistence is less, and its sensibility greater than are those of the uterus. This tumor, too, increases rapidly in size, a fact that will become very evident if there be an interval of two or three weeks between examinations. Kleinwächter advises in a doubtful case using a capillary trocar

[1] Op. cit.

to withdraw some of the fluid from the tumor, and examining it. The introduction of the uterine sound is proper when normal pregnancy can be excluded. Thomas, whose large experience in the diagnosis and treatment of extra-uterine pregnancy entitles his words to great weight, after enumerating the symptoms of this condition, adds:[1] "The physical signs which have sustained the validity of these symptoms are: (1) increased size in the uterus and displacement of it upwards, forwards, or laterally; (2) evidence of vacuity in it yielded by the sound or by a tent; (3) the presence either to one side of the uterus or behind it of a cystic tumor, somewhat painful to the touch, rather immovable, giving to palpation the sense of obscure fluctuation, and in some cases yielding the sign of ballottement. In a few of my cases this sign has been plainly distinguishable, but this has been an exception to a rule, and the absence of it should never be relied on as evidence against the existence of the condition."

These observations refer to the diagnosis of the pregnancy in the early months; after the sounds of the fœtal heart can be heard, parts of the fœtus be felt, and its movements recognized, the diagnosis of pregnancy is conclusive, and in many cases it will not be difficult to ascertain that it is not uterine.

The diagnosis of the different varieties of extra-uterine pregnancy is in the early months impossible; Kleinwächter states that the position of the gestation cyst has but little significance. If the pregnancy has lasted four or five months without rupture of the cyst, the probability is that it is abdominal, and it is almost absolutely certain it is not tubal. Fraenkel found in twenty-six cases of tubal pregnancy seventeen of rupture in the first three months; two lasted to the fourth month, one to the fifth, one to the sixth, two to the eighth month, and two to the fortieth week.

The differential diagnosis of pregnancy in a rudimentary uterine horn from extra-uterine pregnancy is difficult, often impossible, and so far as special treatment is concerned is unnecessary, since such variety is to be treated the same as the other forms of ectopic gestation.

Treatment.—The treatment of extra-uterine gestation is symptomatic, or curative. In the former pain is relieved by external applications, or by opiates; great care must be taken to prevent rupture of the cyst by avoiding any jar or shock to the body, lifting heavy weights, taking severe exercise, or long journeys; much of the time should be spent lying down; laxatives are given so that there may be no straining at stool. If rupture occur, the horizontal position, ice to the abdomen, compression of the aorta, the administration of stimulants, especially if the prostration from hemorrhage be great, and the hypodermatic injection of sulphuric ether will constitute the treatment. The curative treatment is the destruction of the life of the embryo or fœtus, after which it is left in the abdomen or pelvis of the mother, or its removal by laparatomy or by elytrotomy. The application of these methods

[1] Transactions of the American Gynecological Society, vol. vii.

will depend upon the period of pregnancy, upon the position of the gestation cyst, and upon the condition of the fœtus.

Treatment in the First Months.—The most common practice is to destroy the life of the embryo or fœtus. Several ways of accomplishing this have been suggested or practised. 1. Basedow, in 1836, proposed evacuation of the liquor amnii. Eight women of twelve upon whom this operation was performed have died, and it is therefore to be rejected. 2. Giving the mother syphilis with the hope that the child may be infected and die. This was suggested in an interrogative way by Barnes,[1] but no one has had the hardihood to try it; it ought to be unequivocally rejected. 3. Joulin,[2] in 1863, proposed injecting into the cyst atropia or strychnia. Friedrich,[3] in 1864, several times injected morphia into the cyst of a supposed tubal pregnancy, and the result was successful. This method was next tried by Koeberlé, and it succeeded. Rennert[4] had a successful case in 1884, and another in 1885. According to Maygrier there have been now six cases, in five of which the plan was successful. The fatal case was Tarnier's. He used three injections of morphia into the tumor, destroying the life of the fœtus in an extra-uterine pregnancy of between five and six months; the condition of the patient subsequently required laparotomy, and she died.

The Use of Electricity.—Depaul states Dubois first advised electricity to kill the fœtus in normal pregnancy when grave accidents threatened the life of the mother. Bachetti, of Pisa, in 1857, successfully employed electricity in a tubal pregnancy of the third month; two long needles connected with an electro-magnetic machine were introduced into the cyst. In 1865 Braxton Hicks attempted to destroy the fœtus in an extra-uterine gestation of three months and a half by two applications of the galvanic current at an interval of ten days, but failed. In 1869, J. G. Allen, of Philadelphia, succeeded by faradization in arresting pregnancy. Garrigues,[5] in 1882, who himself had a successful case in that year, presented a table of nine cases of extra-uterine pregnancy in which the life of the fœtus was destroyed by the use of electricity; in six of these, including one of Allen's, two of Landis's, and one each of Reeve's, and Lusk's, and his own, a simple one-cell electro-faradic machine was used. In Reeve's[6] case the application of electricity was made when the pregnancy had lasted three months; a uterine electrode was placed in contact with the tumor in the vagina, and an ordinary sponge electrode over its external surface; the current was gradually increased to all the patient could bear, being of considerably greater intensity than she could endure through her hands. The application was begun on the 28th of March, and continued every day for about ten minutes until April 5th. Garrigues[7] gives the following directions as to the application of the faradic current. The negative electrode is introduced either into the vagina or

[1] Diseases of Women.
[2] Traité complet d'Accouchements.
[3] Virchow's Arch., 1864.
[4] Archiv für Gynäkol., 1884, 1885.
[5] Transactions of the American Gynecological Society, vol. vii.
[6] Ibid., vol. iv.
[7] Op. cit.

the rectum, the positive on the abdominal wall. A moderate current may be used for ten minutes or more at a time. The sittings ought, as a rule, to be repeated every day, until the diminution of the fœtal cyst and the retrograde changes in the breasts show that pregnancy has been definitely arrested. As a rule it is best, for safety's sake, to make at least four or five applications. Blackwood, of Philadelphia, who has used electricity successfully in five cases of extra-uterine pregnancy,[1] advocates the application of a strong current continued for an hour, and but a single application.

Péan,[2] in referring to toxic injections into the fœtal mass, observes that the results obtained are not beyond dispute. When failure occurs an extra-uterine pregnancy is demonstrated by the autopsy, or by the discharge externally of some portion of the fœtus. On the other hand, when successes are published one may dispute as to whether there was an extra-uterine pregnancy, and contend that there has been an error in diagnosis. A similar remark would apply with equal justice to cases in which electricity was used.

As to the limit in the duration of an extra-uterine pregnancy for the use of electricity, Garrigues suggests none, stating that it seems probable the current might be safely used at any period of fœtal life. Thomas makes the end of the fourth month the limit.

In some cases diagnosed as extra-uterine pregnancy by able and reputable men, the application of electricity has resulted in the passing of the fœtus into the uterine cavity, and then abortion has followed. Of course such an event is possible only when the pregnancy is interstitial, or tubo-uterine, and then the possibility depends upon the growth of the gestation cyst being towards the uterine cavity so that the uterine mouth of the tube has been already dilated, and least resistance to rupture of the cyst is there offered. Such cases must be exceedingly rare, and it is remarkable that no instance has yet been reported in which the ovum was propelled by electricity toward the abdominal cavity with consequent rupture of the tube.

Abdominal Section.—Opening the abdomen and removing the gestation cyst with its contents, is a practice suggested by Heim, Osiander, Josephi, and Zang.[3] It was recently advocated by Werth,[4] and has been successfully done in two cases by Veit.[5] Undoubtedly this affords the only certain cure, for though the life of the fœtus be destroyed by electricity, the latter remaining in the abdomen of the mother may still be a source of disability, or even of danger.

Elytrotomy.—This operation has been done successfully in the early months of pregnancy when the fœtus was dead, in this country by White, Goelet, and Harrison among others, and by Thomas in the case of a living fœtus. Thomas advises this method if the fourth month of gestation be passed, and the tumor low down in the pelvis. Maygrier takes the position that elytrotomy should not be done if the fœtus

[1] Philadelphia Medical Times, 1886.
[2] Diagnostic et Traitement des Tumeurs de l'Abdomen et du Bassin. Paris, 1885.
[3] Maygrier. [4] Proceedings of the Copenhagen Congress.
[5] Zeitschrift für Geburt. und Gynäkol, 1884, 1885.

is living but that laparotomy is preferable. In either operation the placenta should not be removed.

Rupture of the Cyst.—The general practice is to endeavor by external means to arrest the hemorrhage, and to sustain the patient. But in view of the recent successes of Mr. Tait, who, within less than three years, has performed laparotomy in twenty-one cases of tubal pregnancy immediately after rupture occurred, saving twenty women, it may be accepted that in all such cases, especially if grave hemorrhage occur, the abdomen should be opened, the cyst, if possible, and its contents with the clots removed, the bleeding pedicle ligated, and the peritoneal cavity cleansed. Mr. Tait's success vindicates the position ably maintained by Stephen Rogers, in 1867.[1] This success, too, presents a striking contrast with the mortality of that expectant treatment. Thomas states that in five cases of rupture of the sac, no operation being done, death occurred in four.

Treatment in the Second Half of Pregnancy.—If the pregnancy passes the fourth month it is almost certainly abdominal, and will probably go to term, when false labor occurs followed by the death of the fœtus. Should an effort be made to save the fœtus by abdominal section done at or near the end of the pregnancy? The deplorable mortality of the operation to the mothers gives up to the present time a negative answer. "According to the researches of Prof. Richard Werth, of Kiel, Germany, made in 1884, there have been seventeen true primary operations with fifteen deaths, the two non-fatal ones having been performed within ten years."[2] One of the successful operations was by Jessop, of Leeds, and the other by Martin, of Berlin. Of the seventeen infants all were living, but nine lived only from one to fifty hours after extraction. In two of the seventeen cases, those of Sale[3] and of Wilson,[4] there were twin pregnancies, one fœtus within, the other without the uterus, and the four children lived. Péan,[5] however, takes the ground that the danger is no greater to the mother than from the expectant treatment, and that it gives decided chances of saving the child.

Should the operation be done after the death of the fœtus?[5] Only in case the mother's condition require it, for it is possible the change of the fœtus into a lithopædion will occur, and it may be thus carried through many years without injury or serious inconvenience to the mother. Early intervention, too, exposes her to special danger from the circulation in the placenta still continuing, and therefore great liability to hemorrhage; according to Litzmann the placental circulation is not completely arrested until the fourth or fifth month. Even then the expectant plan is indicated unless symptoms demand interference. But serious symptoms may arise either with or without rupture of the gestation cyst; in the former case the remains of the fœtus may be eliminated by the abdominal wall, by the vagina, rectum, bladder; the first two are the most favorable. The practitioner will assist the discharge which nature is endeavoring to effect, by enlarging the opening that

[1] Transactions of the American Medical Association, vol. xviii.
[2] Harris, International Encyclopædia of Surgery, vol. vi.
[3] New Orleans Med. Journ., 1870. [4] American Journal of Obstetrics, 1880.
[5] Op. cit.

has been made, or by anticipating such opening in the abdominal wall or in the vagina. In case the opening be in the intestine too high to be reached by the finger, laparotomy is indicated. Of course, local antisepsis is very important in all cases. If symptoms require an operation when the cyst is unruptured, laparotomy, or, if the cyst present low in the pelvis, elytrotomy is indicated. Maygrier's statistics show that the mortality in the second half of pregnancy, the fœtus being alive, is 88.3 per cent. from laparotomy, and 50 per cent. from elytrotomy; while laparotomy after the fœtus is dead has a mortality of 35.7, and elytrotomy 41.6 per cent.

Ectopic Development of the Placenta—Vicious Insertion of the Placenta—Placenta Prævia.—Benjamin Pugh, in his treatise upon Midwifery, 1754, remarked that "the placenta sometimes loosens before the membranes, which contain the waters, are broke, and by the child's turning itself, it is sometimes found to present at the mouth of the womb," etc. This was the explanation generally given by obstetricians of those cases in which the placenta was found at the mouth of the womb previous to the birth of the child. Nevertheless, Paul Portal, in 1685, had spoken of firm adherences between the placenta and parts contiguous to the mouth of the womb; and Schlacher, in 1709, had given an anatomical demonstration of this condition upon the body of a woman dead from uterine hemorrhage. Rigby, whose admirable "Essay"[1] was published in the latter half of the eighteenth century, made a distinction which is still recognized, between accidental and unavoidable uterine hemorrhage, the former occurring when the placenta occupied its normal position, the latter when "it is fixed to that part of the womb which always dilates as labor advances." It will be observed by the words just quoted from Rigby that those authors who have attributed unavoidable hemorrhage, occurring in pregnancy, to the abnormal situation of the placenta, have no authority from him for such use of the word unavoidable. Rigby's definition of placenta prævia is that which is in accordance with the most recent knowledge. For example, Spiegelberg has said that the placenta is prævia when a greater or less part of it is situated in that part of the lower segment of the uterine body which must be stretched in labor. He further compares this part of the uterus to the segment of a hemisphere which during parturition must be converted into a cylindrical canal.

Varieties.—These are central, partial, marginal, and lateral. In the first the centre of the placenta corresponds more or less nearly in situation with the internal os uteri. In the second variety the os uteri is also covered by the placenta, but the margins of the latter are not equidistant from it—on one or the other side of the os a placental margin is readily reached. In the marginal variety the os is not covered, but the placental edge projects to it, or possibly partially over it. In lateral placenta prævia the placenta reaches nearly to the os. "The frequency increases progressively from the first to the last."

[1] An Essay on the Uterine Hemorrhage which precedes the Delivery of the Full-grown Fœtus, illustrated with cases. The fourth edition was issued in 1789.

Frequency and Causes.—1 in 573, Johnson and Sinclair; 1 in 575, Guy's Hospital Lying-in Charity, Galabin; 1 in 1000, Spiegelberg. In adding up the statistics given by Depaul, from Ramsbotham, Schwartz, Arneth, Klein, Collins, MacClintock, and Hardy, and from the Maternity at Wurzburg, and the *Hôpital des Cliniques de la Faculté de Paris*, amounting in all to nearly 600,000 obstetric cases, I find the proportion of cases of placenta prævia 1 to a little more than 1200. It must be remembered that many cases of placenta prævia result in abortion, so that the relative frequency of the number of pregnancies with normal, and those with abnormal implanatation of the placenta cannot be determined.

Placenta prævia is at least six times more frequent in multiparæ than in primiparæ. It is more frequent in the poor than in the rich, either, as suggested by Spiegelberg, because of hard work in the early part of pregnancy, or more probably from subinvolution of the uterus. He quotes two remarkable cases from Ingleby, in which the oviducts entered the uterus near the internal os; one of these women had placenta prævia three, the other ten times. Multiple pregnancy creates a liability to the ectopic development of the placenta, and also the previous occurrence of the accident. Abnormal size of the uterine cavity, diseased condition of its lining membrane, and spasmodic contractions of the uterus, have been enumerated among the causes; and, very strangely, the standing position in coitus, and epidemic influence.

Diagnosis of the Different Varieties.—If the os be penetrable the finger can touch only placental tissue in the central variety; in the partial, by carrying the finger far in, placental tissue is felt on one side, but on the other the membranes; in the marginal variety, the border of the placenta and the membranes are each felt, provided dilatation of the os with effacement of the neck has not occurred, but if it has, the placenta has been carried up with the internal os, and unless the finger enters far in, only membranes are felt. In lateral placenta prævia the placenta is not felt unless the hand enters the uterus.

Vaginal Ballottement.—This is impracticable, chiefly because the uterine wall being lined by placenta the fœtus is further removed from the fingers in the vagina, and it is impossible to communicate an impulsion to it by them. But in addition to this, vaginal ballottement is prevented in many cases by the fact that the presentation is transverse. The frequency of transverse presentations is not caused by the presence of the placenta in the lower uterine segment; it occupies too little space to produce such an effect, but by the generally relaxed condition of the uterus, and from the fact that labor in many cases is premature. Depaul's statistics show that shoulder presentation occurred once in nine cases. This proportion is still greater according to the statistics of some other authorities. Thus Charpentier found in 1148 cases of placenta prævia 66 per cent. head presentations, 24 per cent. transverse, 9 per cent. foot and breech. Lomer had 51 per cent. head presentations, 32 per cent. transverse, and 9 per cent. foot and breech presentations.

The Placenta.—This frequently is thinner than usual, and is attached to a larger uterine surface. An explanation of the more extensive

attachment of the placenta suggested by Galabin is, that the lower segment of the uterus being less adapted for supplying nourishment to the placenta, the placenta has become extended as a compensation. The attachment of the cord is oftenest at or near the margin; in some instances it is velamentous; the position of the cord favors its prolapse, a not unfrequent complication of labor in placenta prævia.

Hemorrhage.—The dominant symptom of placenta prævia is uterine hemorrhage. This rarely occurs before the sixth month, and is most frequent from the eighth to the ninth month, and during labor. Depaul has stated that almost all the hemorrhages connected with placenta prævia occur in the last six weeks of pregnancy. It is usually sudden, frequently without obvious cause, is external, and is intermittent, several days often intervening between attacks.

The Source of the Hemorrhage.—When the placenta is partially detached there are two surfaces with torn vessels, one placental, the other uterine; from which does the bleeding come? Somewhat and briefly from the placental, but its chief source is the uterine surface. The proofs which authorize this statement are, first, the hemorrhage may continue after labor is over; second, it may continue during labor when the fœtus is dead; third, if a pregnant animal be opened so that the interior of the uterus is exposed, and the placenta be partially detached, the blood is seen to come from the uterine surface. The theory of the placental origin of the bleeding was held by the late Sir James Simpson. He said, in 1845: "I belive with Dr. Hamilton and others that the discharge issues principally or entirely from the vascular openings which exist on that exposed placental surface." Acting upon this theory, he was led to uphold the practice of detaching the placenta in case it presented at the mouth of the womb, and became involved in a controversy with Robert Lee[1] in regard to both his theory and practice, and in one with Radford, who claimed priority in this method for Kinder Wood and himself.

The Causes of the Detachment of the Placenta.—Those who hold that hemorrhage prior to labor is accidental, at the same time state that the accident is much more liable to occur in ectopic development of the placenta than when this organ occupies its normal position, and that, as taught by Rigby, unavoidable hemorrhage occurs only in childbirth. Others explain the detachment of the placenta by failure of correspondence between its development and that of the uterus. But while Jacquemier[2] attributes to the uterus such rapid development that the placenta cannot follow it, Legroux upholds the opposite—that is, the placenta is extended too rapidly with reference to the lower uterine segment. According to one hypothesis the uterus grows away from the placenta, and according to the other the placenta grows away from the uterus. Barnes has maintained the latter view, and has recently stated,[3] "that the first detachment of the placenta arose from an excess

[1] This controversy was exceedingly bitter, especially on Dr. Lee's part. In one of his last—if not the last—contribution upon the subject, he denounced Professor Simpson's view as to the source of the hemorrhage as "a gross, unparalleled, and unretracted blunder." (Lancet, vol. ii., 1847.)

[2] Placenta Prævia, by Auvard.

[3] Obstetric Medicine and Surgery.

of growth of the placenta over that of the lower region of the uterus to which it was attached; that the structure of the uterine region was ill-fitted to keep place with the placenta; hence loss of relation, the placenta shoots beyond its site, and hemorrhage results." But Bitot[1] answers this theory by the statement that at the time in pregnancy when the hemorrhages usually occur, the development of the placenta has been completely accomplished. (Depaul.) Further, if it be true, as claimed, especially by French authorities, that the development of the fundus is completed in the first seven or eight months, if the placenta were attached to it, or in its vicinity, the rapid growth of the placenta at the time alleged by Barnes would be in all cases a necessary cause of hemorrhage.

Depaul has said[2] that "it may be stated that the hemorrhage consequent upon vicious insertion of the placenta results from this, that all the parts of the uterus are not developed in the same stage, and while the fundus and adjoining portions take at the beginning of pregnancy a considerable amplitude, during the first six months the lower segment of the uterus, on the contrary, is not notably developed but during the last three months. Moreover, the development of all these regions is not made in a uniform manner. I have had the opportunity of examining the uterus of women who have died in the last months of pregnancy, and I could see in the inferior portions that the increase was not everywhere the same. The anterior is generally developed much more than the posterior, and as I have said in a report which I presented to the Academy, if a perpendicular be let fall from the fundus, this line does not pass through or near the cervix, but traverses the anterior wall at a variable distance from this opening." The author further states that the lateral parts have an unequal growth, one increasing more than the other, while it is impossible to fix precisely the part of the fundus which is enlarged most, and when this development is arrested; on the other hand the inferior segment assuredly is enlarged later, and it may be said in general that this development begins from the sixth to the seventh month. Spiegelberg, however, entirely rejects this view in explaining the hemorrhage resulting from placenta prævia.

No matter, however, which hypothesis be accepted, it is obvious that the hemorrhage is unavoidable. Spiegelberg maintained that the bleeding arises from uterine contractions, causing partial detachment of the placenta; when premature[3] labor occurs, as it very frequently does in placenta prævia, it is not caused by the hemorrhage, but it causes the hemorrhage.

Prognosis.—The maternal mortality is in general probably twenty-five to thirty per cent. But if professional help can be had promptly it is much less. Naegele has said that the insertion of the placenta upon the internal os is one of the most unfortunate of nature's errors. The same vital acts which are designed to open an entrance for the

[1] Contribution à l'Étude du Mecanisme et du Traitement de l'Hémorrhagie liée a l'Insertion Vicieuse du Placenta.

[2] Leçons de Clinique Obstétricale.

[3] According to King's statistics (Transactions of the State Medical Society of Indiana), premature labor occurs in about one-half the cases. Lomer's statistics correspond in this respect.

foetus to the exterior world, and give the mother the hope of soon clasping in her arms the child she has borne more or less painfully within her, involve most frequently the loss of both mother and child, if art does not opportunely intervene in order to save them. The prognosis varies with the character of the placental insertion. Thus, in the tables given by Depaul in 25 cases of central insertion there were 14 deaths; in 31 in which the os was incompletely covered by the placenta, there were only eight deaths; in 15 cases where the placenta was near the os, there was no death. Danger is not over when delivery has occurred, for these patients are peculiarly liable to post-partum hemorrhage, and also to septicæmia. The fœtal mortality rarely falls under 50 per cent., and in some statistics rises to 70, or even to 75 per cent.

Treatment.—If loss of blood be slight, and especially if the fœtus be not yet viable, the expectant plan is indicated. The patient should lie down, be lightly covered, use cold drinks, and if much pain or restlessness be present, opium may be given. She ought to be directed not to take active exercise, to avoid as much as possible the erect position, and all straining at stool. It would be well if there were some one at hand who was properly instructed in the application of the vaginal tampon, so that this may be at once used should grave hemorrhage occur.

But if the fœtus is viable, and the hemorrhage is severe, the doctrine enunciated by Baudelocque nearly three-quarters of a century ago ought to direct the treatment.[1] "The necessity of effecting delivery without having regard to the time of pregnancy, when the loss of blood is so abundant as to imperil the life of the mother and that of the child, has been recognized for more than two centuries." Admitting this principle, the question arises as to how the delivery is to be effected. The simplest, shortest, and safest way is to induce premature labor, or, as nature is in many cases endeavoring to do this, assist her efforts. This practice has been especially advocated by Greenhalgh and Thomas, while many others have been following it without calling it the induction of premature labor. By the use of Barnes's dilators the os is effectively plugged, and at the same time its rapid expansion secured, when if the presentation be favorable and the uterine contractions active, the membranes may be ruptured, and the completion of labor left to nature. A strong argument in favor of the induction of premature labor is, statistics show that the maternal and fœtal mortality are very much greater when labor occurs at term than when it is premature.

Different Methods of Treatment of Placenta Prævia.—Having stated the general principle which should govern the treatment of placenta prævia, and the way in which this may be accomplished, it is proper that other methods should be briefly mentioned.

1. *The Tampon.*—French obstetric writers have given to Leroux, 1776, the chief credit for the use of the tampon; nevertheless this author mentions no instance of its application in placenta prævia. The honor

[1] Traité des Accouchements.

of this application of the tampon undoubtedly belongs to Wigand; by means of it he attained a success in the treatment of placenta prævia quite equal, if not superior to, that of any other method. At the time he was led to make use of the tampon *accouchement forcé* was the general practice, a practice which involved serious dangers and great fatality. After many years' experience with the tampon, and having had a large obstetric practice, Wigand stated that he "had not lost a single child or mother," and that had secured by the method a normal lying-in. It is interesting in an historical point of view to read the particular method pursued by him, and therefore the following extract is presented:—[1]

"As soon as the first labor-pains begin, in some cases, at the first occurrence of decided hemorrhage, I prepare a large tampon of soft linen, dipped in a thin, oat-meal gruel; and the broad end, which is first passed into the vagina, is thickly covered with powdered gum arabic and rosin. The tampon is then introduced, so that it lies in the mouth of the womb, close to the already loosened part of the placenta. In order that the tampon may remain fixed and immovable in the same place, I further fill the vagina in all directions and in all crevices as firmly with linen or fine sponge as can be done without inconvenience to the patient. A thick napkin is closely applied over the genitals, and the parturient then lies upon her left side, with her thighs close together. I hold this position to be the most suitable, because then the placenta, not with its centre, but its border, first enters the vagina; for my observation has taught me that, as a rule, it is the right side of the placenta which is first loosened and comes out of the uterus." After referring to the diseased dynamic conditions of the womb which may occur, and which the physician upon discovering must endeavor to remove, etc., Wigand states that should the patient after some hours complain of burning in the vagina, he takes out the tampon, replacing it by a fresh and smaller one. "But before the introduction of the latter I observe as to the following: Whether the mouth of the womb is considerably dilated, and whether the placenta has already begun to separate from one side or the other, usually the right. Whether the head or the feet, or some other part of the child, presents. Whether, especially at one side of the cervix, again generally the right side, the presenting bag of water is tense and elastic. And whether one can perceive that the presenting part of the child, as well as the separated border of the placenta, equally move down. If I find any other part of the child than the head, the feet, or the pelvis presenting, I proceed at once to turn the child, doing this with a much greater confidence, as the os is already softened and dilated, and the uterus has entered upon the birth-work and will complete my purpose.

"Once more, is the child's position normal, the configuration of the uterus good, the pains strong and efficient, the progression of the child

[1] I have taken this from a volume of Wigand's writings, entitled Die Geburt des Menschen, etc. The work was edited by Franz Carl Naegele, and published in 1820, three years after Wigand's death. Notwithstanding the success of his method which he had been pursuing for so many years, and his frequent publications concerning it, he stated that as far as he knew he had not "a single follower."

Wigand must have begun the tampon treatment early in the present or possibly in the latter part of the last century. Nevertheless, a recent writer has stated that it was "about fifty years ago;" but, as Wigand has been dead for nearly seventy years, of course this is a mistake.

decided, the tendency of the loosened placenta to place itself at the side of the vaginal wall plain—if the patient's pulse is full and slow, her temperature good, or even, which is here especially desirable, she has a warm perspiration—I leave the rest of the labor entirely to nature, which alone, sooner or later, by means of unusually rapid and powerful pains, will expel the living, healthy child, at the same time, also, the second small tampon, if such has been found necessary to introduce. The placenta was spontaneously expelled in all cases shortly after the birth of the child."

Wigand further remarks: "I do not deny that my method, like any other, has sometimes its own difficulties and complications. Thus, for instance, it cannot be applied with women whose birth-passage is so irritable that they cannot retain the tampon even for the space of fifty minutes; so, too, one would act very unreasonably, and even criminally, were he to use the method when called to a woman who had bled almost to death. But in so many other cases, and applied at the beginning of the labor or of the blood-flow, this method is and remains the most successful. And, even if nothing else shall be conceded to it, it cannot be denied that of all methods it is the most suitable and reliable to properly prepare for the operation of turning, if the latter has become necessary, facilitating it for the parturient and for the operator."

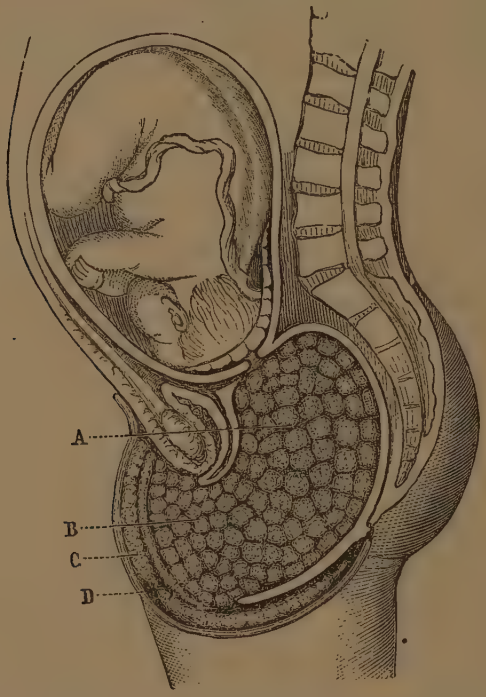
These quotations prove the priority of Wigand in the tampon treatment of placenta prævia, and also show the extraordinary success which attended this method in his practice. It is important to observe, too, that he did not place exclusive reliance upon it, not regarding it as suitable for all cases.

No one now would employ Wigand's tampon, though really it would be much better than the sponges which are by some used to arrest uterine hemorrhage, a practice that cannot be too severely condemned. So, too, rubber bags introduced flaccid in the vagina, and afterward distended with air, are, in the opinion of most obstetricians, unreliable, for they cannot be perfectly adapted to the vaginal vault, and thus leave a space in which blood may collect. Other objections that have been made to the colpeuryntер are that it is liable to tear, and that it may be the medium of infection. The best tampon is made of balls of absorbent cotton, each ball being about the size of a small walnut; fifty or sixty of these will generally be required—a hatful, according to Pajot. The bladder and rectum should be emptied, the vagina thoroughly cleansed by an antiseptic solution, and all clots removed; the patient may lie upon her side or upon her back, the latter position is selected if Sims's speculum be used, but this instrument is not essential for perfect tamponing of the vagina. The obstetrician takes one of the cotton balls after it has been dipped in an antiseptic solution, or covered with an antiseptic ointment, that of iodoform is excellent, and by means of suitable dressing forceps carries it up to the vaginal vault; one after another is thus introduced until the vault is completely packed; the os is filled or covered with the cotton packing, and after this the rest of the vagina is completely filled, a large piece of cotton placed between the labia, and the whole secured by a napkin and a T-bandage. The dossils of cotton first introduced may each have a string attached to them to facilitate their removal. The use of astringent solutions into which the balls are dipped is unnecessary, and may be injurious by irritating the vagina; arrest of bleeding by

pressure, not by coagulation, is the purpose accomplished by the vaginal tampon.

The tampon has another important effect in the majority of cases: it excites uterine contractions, thus in 78 out of 128 cases given by Müller,[1] strong uterine contractions followed its application.

FIG. 108.



VAGINAL TAMPON IN PLACENTA PRÆVIA.—*A*. Deeply placed dossils to each of which a cord is attached. *B*. Superficial dossils without cord. *C*. Pledget of charpie or pad of cotton. *D*. T-bandage.

According to Lusk the tampon should be removed in at least four hours, but Tarnier would let it remain twelve hours; Depaul did not remove it for at least twelve or fifteen hours, or twenty-five or thirty hours at most; it is doubtful if any harm will result should a properly applied antiseptic tampon be left for twenty-four hours. After its removal the vagina should be thoroughly cleansed with an antiseptic solution; a new tampon should be introduced if hemorrhage continues, and if immediate delivery is not practicable, unless the practitioner, following the method pursued by Pajot and Bailly, and which, as we have seen, was that of Wigand, leaves the tampon in place to be expelled by the uterine and abdominal contractions which expel the fœtus; this plan was practised and warmly advocated for many years by the late Dr. Mears of Indianapolis. Exclusive reliance upon the tampon in

[1] Placenta Prævia.

the treatment of placenta prævia is the practice of only a few practitioners; the majority of those who use the tampon regarding it as simply a temporary means. Müller,[1] after observing that it is neither a sovereign remedy, as its friends claim, nor to be entirely rejected as its opponents desire, remarks that it is an important aid which should be used at the right time and then no longer than is necessary; apply it when the os is rigid and only slightly opened, if violent hemorrhage occurs, for immediate delivery is impossible; time is thus gained without danger, for even if it does not stop, it lessens the bleeding, and prepares the parts for labor.

It has been objected to the tampon that it may convert an open into a concealed hemorrhage. The answer is, that in no case has such a result followed the use of a properly applied tampon. If during active labor the tampon is forced down by utero-abdominal contraction, and then when the contraction ceases there is recession of the uterus, leaving a space at the upper surface of the tampon in which blood may collect, the accident is prevented by the practitioner at once pressing the tampon back as soon as the bearing-down effort ceases; or the same object may be accomplished by having the bandage which secures it made of elastic material which retracts after having been stretched during the uterine and abdominal contraction. Bailly[2] has stated, in considering the treatment of placenta prævia, that authors are unanimous upon this point. Whenever in pregnancy or in the first part of labor a hemorrhage, dangerous in amount or continuous, occurs, we ought to tampon. Madame Lachapelle's observations prove that sometimes she left the delivery in women she had tamponed to nature. Doctors Weil and Pajot, the latter preceding the former, taught that after having tamponed women suffering with hemorrhage from placenta prævia one ought to abandon the delivery to nature, this method giving the best results for the mothers. The tampon should be closely applied to the os during a uterine contraction, so that no space will be left for the accumulation of blood. Bailly makes the following conditions necessary for the use of the tampon: First, there must not be uterine inertia. Second, the tampon must be properly made and applied; the pieces of charpie should be covered with cerate, and a speculum should not be used in their introduction. Third, the presentation must be cranial or pelvic.

According to the statistics given by Auvard, when the tampon was used the maternal mortality was 6 per cent., and the fœtal mortality 55 per cent.

Ergot.—This is given by Auvard as the method of Paul Dubois. Statistics show that the results of this treatment are: maternal mortality 42 per cent., and fœtal mortality 77 per cent. If no ergot be given, the former is 24 per cent., and the latter 47 per cent. Auvard adds that these figures are eloquent. Ergot given in these conditions kills almost one-half of the mothers and more than one-third of the children.

Complete Detachment of the Placenta.—This has already been referred to as the method of Simpson. While the results as furnished by

[1] Op. cit.

[2] Gazette des Hôp., 1873.

Simpson's statistics were very favorable in regard to maternal mortality, they showed an enormous fœtal mortality; it should be stated that the statistics of others are less favorable in regard to maternal mortality, and the method has now only a mere historical interest.

Partial Detachment of the Placenta.—There are three varieties of this: Barnes's, Cohen's, and Davis's.

The Method of Barnes.—This is founded upon the proposition that the "physiological arrest of flooding is neither permanent nor secure until the whole of that portion of the placenta which had adhered within the lower zone of the uterus is detached—that being the portion which is liable to be separated during the opening of the lower segment of the uterus to the extent necessary to give passage to the child."[1] His directions as to detaching the portion of the placenta involved in this dilatation are as follows: "Pass one or two fingers as far as they will go through the os uteri, the hand being passed into the vagina, if necessary; feeling the placenta, insinuate the finger between it and the uterine wall; sweep the finger round in a circle, so as to separate the placenta as far as the finger can reach; if you feel the edge of the placenta where the membranes begin, tear open the membranes freely, especially if they have not been previously ruptured; ascertain, if you can, what is the presentation of the child before withdrawing your hand. Commonly, some amount of retraction of the cervix takes place after the operation, *and often the hemorrhage ceases.* You have gained time. You have given the patient the precious opportunity of rallying from the shock of a previous loss, and of gathering up strength for further proceedings."

"If the cervix being now liberated, under the pressure of a firm binder, ergot, or stimulants, uterine action returns so as to drive down the head, it is pretty certain there will be no more hemorrhage; you may leave nature to expand the cervix and to complete the delivery, the labor, freed from the placental complication, has become natural." Murphy,[2] pursuing the plan of partial detachment of the placenta, as advised by Barnes, and dilatation of the os by Barnes's dilators, in 23 cases saved ten children, and all the mothers. His treatment will be more fully stated.

Cohen's Method.—Two fingers, the index and medius, are introduced into the os, and made to penetrate between the placenta and the uterine wall in that direction offering least resistance, until the membranes are reached; the fingers are hooked over the border of the placenta, the membranes ruptured, and the corresponding semicircle of placental attachment is broken, and the placental flap thus made is drawn toward the vagina so as to project from the mouth of the womb. Cohen reports three cases; the mothers were saved, but the infants were lost.

Davis's Method.—In a paper presented to the Pennsylvania State Medical Society in 1876, Dr. Davis, of Wilkes-Barre, advised the following "material modification of Barnes's operation," as he terms it. "As soon as the os uteri will admit two or three fingers, pass the

[1] Obstetric Operations. [2] Medical Press and Circular, 1885.

hand into the vagina. Ascertain by sweeping the finger between the placenta and uterus, without disturbing their connections, on what side the separation of the placenta is most extensive. That will always be the side of the least extensive attachment. Introduce two or three fingers on that side up between the placenta and uterus until the border of the placenta, where the membranes begin, is reached, severing the attachments as you go, if any remain; then hook the fingers over the border and draw the placenta forcibly down, and pack it closely to the other side. The membranes will of course come down with it, and will protrude through the open mouth of the womb. Rupture the membranes at once, and empty the womb of the waters as thoroughly as possible. The head, if it presents, and if pains are active, will now engage in the os, and will crowd the placenta to the side of the cervix on one side, and will block up the open mouths of the vessels upon the recent seat of the placenta on the other, and the hemorrhage will cease. In every case in which I have resorted to this procedure, such has been the happy result, and I have been left free either to allow the labor to end naturally, or to end it by the forceps."

Bitot[1] sees no difference between this and Cohen's method.

Rupture of the Membranes.—The method is generally known as that of Puzos. This obstetrician, in 1759, described his treatment of placenta prævia as consisting in dilatation of the os with his finger, and then rupture of the membranes. According to Auvard, the results of the method of Puzos at the *Clinique d'accouchements* and the *Maternité* were a maternal mortality of 13 per cent., and a fœtal mortality of 46 per cent.

Rupture of the membranes is not in all cases followed by arrest of the hemorrhage. Thus in Müller's[2] statistics it is shown that while bleeding ceased in six cases, in five others it continued or increased. There must be active uterine contractions to secure hæmostasis; if these are not present, or do not follow the discharge of the amniotic liquor, the reliance upon this plan will prove a sad error. Moreover, without some dilatation and dilatability of the os, this plan should not be followed.

Combined Turning.—This method is thus described by Lomer:[3] "Turn by the bimanual method as soon as possible, pull down the leg, tampon with it and with the breech of the child the ruptured vessels of the placenta. Do not extract the child then, let it come itself, or at least only assist its natural expulsion by gentle and rare tractions. Do away with the plug as much as possible; it is a dangerous thing, for it favors infection, and valuable time is lost with its application. Do not wait in order to perform turning, until the cervix and the os are 'sufficiently dilated to allow the hand to pass.' Turn as soon as you can pass one or two fingers through the cervix. It is unnecessary to 'force your fingers through the cervix' for this. Introduce the whole hand into the vagina, pass one or two fingers through the cervix, rupture the membranes, and turn by Braxton Hicks's bimanual method. Use chloroform freely in performing these manipulations. If the pla-

[1] Op. cit. [2] Op. cit. [3] American Journal of Obstetrics, vol. xvii.

centa is in your way, try to rupture the membranes at its margin; but if this is not feasible, do not lose time, perforate the placenta with your finger, get hold of a leg as soon as possible, and pull it down." Lomer states that putting the statistics derived from Hofmeier, Behm, and from his own practice, in the most unfavorable light, as including several cases treated by other methods before the bimanual method was employed, the maternal mortality was only 10 per cent. The fœtal mortality was 66 per cent.

In reference to the general subject of podalic version in placenta prævia, the following extract from Rigby is of interest:[1] "From what has been said it appears, then, that the placenta is fixed to the os uteri much more frequently than has hitherto been supposed; that when it is so situated, nothing but turning the child will put a stop to the flooding."

Murphy's Method.—Having previously stated the extraordinary success obtained by Murphy, it is proper that his method shall be presented in full, and this will be done in his own words:[2]—

"The practice which I follow, consists, not in a single method for stopping hemorrhage, but in several, and it is this: In the first place, in every one of my own patients, or in those that I am consulted about, when hemorrhage occurs after the seventh month, when it is clearly not from the cervix or os, and when there is presumptive evidence that it is from the placenta prævia, I advise premature labor to be introduced, or before that period of pregnancy when the hemorrhage is severe, continuous, or frequently recurring. In cases that permit of a little delay from the symptoms not being very urgent, I appoint a time when I can give a few hours' continuous attendance—two hours is generally sufficient—as once you commence to induce labor I consider it necessary to remain with the patient until delivery is accomplished; and when the case does not require instant action one can fix his own time and can have what assistance he requires."

"I find having an assistant a great advantage, and by thus arranging a definite time practitioners can secure the services of a specialist or fellow-practitioner to help them and to share the responsibility. On examination, if the cervix will permit it, I introduce my finger, separate the placenta all around, and then put in a Barnes bag; and if not I gently and slowly insinuate my finger through the os, which I have always found easy of accomplishment, never having had recourse to the preliminary introduction of a tent, though in inducing labor for other causes I have frequently had to introduce tupelo tents. Having thus dilated the cervix with my finger, I separate the placenta freely around the internal os, and at once introduce a Barnes bag. I slowly fill it with water—and here let me give a practical hint on the use of hydrostatic bags, which I do not remember to have seen mentioned in any of the text-books: When the bag is well through the cervix it is very difficult to say how full it is, and by continuing the injection it may very easily be burst, as once happened to myself, and has, I know, happened to many others; so, to avoid this, it is desirable to ascertain and remember how many syringefuls each bag requires

[1] Op. cit. [2] Medical Press and Circular, 1885, p. 208.

before being fully dilated, and then to carefully inject only that number. Having thus filled the bag, I wait patiently until the os is well dilated around it, and, before introducing another one, separate the placenta further should the hemorrhage continue, which it does not provided the placenta has been sufficiently separated at first. After the bag has been introduced for some time the pains come on fairly well, though as a rule they are not very strong.

"I thus proceed until the os is fully dilated, when I give ergot freely, and decide what is the most suitable course to follow. If the placenta is lateral or marginal, and the pains fairly strong, I rupture the membranes and leave the case to nature; or, if the head is well into the pelvis, I may apply the forceps, but in the great majority of cases I perform version, preferably by the combined method, and deliver the child as quickly as is consistent with the safety of the mother."

In reviewing these different methods of treatment, it is seen that the one followed by Murphy has given the best results. When it was employed before the beginning of labor, out of 9 cases, all the mothers were saved and 7 of the children. This sustains, too, the position taken in the beginning of the consideration of the treatment, viz, the "induction of premature labor in all cases of placenta prævia, when the hemorrhage is serious."[1] Nevertheless, the number of cases in which Murphy's modification of Barnes's plan, conjoining with partial detachment of the placenta dilatation, has been used is too small to establish an absolute rule, and moreover similar results ought to be obtained by other practitioners, before it is to be received as the best way of treating placenta prævia. Certainly it commends itself in that the means by which early delivery is secured at once promote rapid dilatation of the os, and prevent in great degree hemorrhage during this process. Possibly the dilatation is more important than the detachment; the latter incidental, the former essential; nevertheless, as stated by Murphy, he attaches very great importance to partial detachment of the placenta as a means for arresting hemorrhage.

The practitioner will act wisely who adapts his treatment to the conditions of the case; it may be necessary to use the tampon, temporarily at least, in one case, to use dilators in another, to perform podalic version in a third, to apply forceps in a fourth, to simply rupture the membranes in a fifth, or to give ergot, or to combine two or more of the various methods, all these when so used being but means to one end—delivery.

To this presentation of the subject I add the following statement of the results and general plan of treatment of placenta prævia in the practice of Dr. Ellwood Wilson. In 6400 cases of labor he had 30 cases of placenta prævia; 2 mothers and 8 children died. In regard to treatment, Dr. C. M. Wilson remarks, "I am instructed by my father to say that he uses ergot before delivery to secure tonic contraction of the uterus; that he ruptures the membranes and carries his hand, if possible, around the margin of the placenta to reach the

[1] The writer advocated this treatment several years ago. American Practitioner, 1875, 1876.

head and cause it to engage. If this manœuvre does not control the hemorrhage, he turns and delivers as rapidly as possible." The experience of both Murphy and Wilson—the results that they have had being so remarkably good—establishes the fact that ergot is not to be rejected in the treatment of placenta prævia, and that the statement of Auvard, which has been previously quoted, is too absolute.

Hemorrhage occurring after delivery, a by no means rare sequel of placenta prævia, will be considered in the treatment of post-partum hemorrhage.

Hemorrhage in Normal Implantation of the Placenta.—Dangerous hemorrhage may result in the latter part of pregnancy, or in labor from premature detachment of the placenta when this organ occupies its normal situation in the uterus. The hemorrhage may be either open or concealed. The following history of a case of the former variety which occurred recently during my service at the Philadelphia Hospital has been furnished me by the resident physician, Dr. John Chalmers Da Costa, under whose charge she was.

J. L., thirty years of age, multigravida, when at the end of the seventh month of pregnancy, slipped and fell, the right iliac region striking a boiler. She immediately had severe pain, and blood flowed from the uterus to the amount of nearly a quart in a few minutes, then stopped. The finger readily entered the external and then the internal os. The pulse was rapid and very weak; the expression anxious; body agitated with tremors and covered with cold sweat; pupils dilated; heart's action weak, irregular, and beats intermittent; respiration shallow and hurried. Immediately upon being placed in bed she was given whiskey and aromatic spirits of ammonia; the head of the bed was lowered by raising the foot; the vagina was washed out with a hot solution of corrosive sublimate, and opium given freely. The hemorrhage did not return, and the pain gradually subsided in two days. The pregnancy went to term, when she was delivered of a healthy, well-developed child.

This case illustrates the fact that a grave uterine hemorrhage does not necessarily arrest the pregnancy. Unfortunately, not being present after the labor, I did not have an opportunity of examining the placenta; I am confident careful examination would have found some lesion resulting from the fall which caused the hemorrhage. This case also shows one of the most frequent causes of the so-called accidental hemorrhage—direct violence. It may also occur from uterine contractions, or from acute diseases, as variola, scarlatina, typhoid fever, and acute yellow atrophy of the liver. Lifting a heavy weight, violent coughing, and straining at stool have been given as causes.

Recently Winter[1] has shown a connection between nephritis and premature detachment of the placenta in three cases. "None of the usual causes for premature detachment—cough, vomiting, straining at stool, etc.—were present; no history of injury or congestion of the uterus was obtainable. On the other hand, in each of my cases nephritis was present. In the first case it was probably due to preg-

[1] Zeitsch. f. Geb. u. Gyn. xi. p. 398. See abstract American Journal of the Medical Sciences, Jan. 1886.

nancy, and associated with a hemorrhagic diathesis; in the second the nephritis was chronic; the third was a case of typical nephritis of pregnancy, and left no doubt of the connection between nephritis and the premature detachment of the placenta."

Concealed accidental hemorrhage is the much more serious form of the disorder. The subject has been especially studied by Goodell, who has collected 106 cases.[1] He enumerates among the prominent symptoms an alarming state of collapse, pain, which in the majority of cases is referred to the site of the placenta, absence or extreme feebleness of the pains of labor, and a marked distension of the uterus. "Very often,[2] before the lapse of many hours, a show of blood, ranging from an ooze to a gush, will clear up all obscurity; but this trustworthy symptom does not usually occur at the outset of the attack, but at a time when it may be too late to interfere."

The mortality of the mothers in the cases collected by Goodell was nearly 51 per cent., and that of the children 94 per cent. Galabin states[3] that out of 23,591 deliveries in the Guy's Hospital Lying-in Charity there were 31 cases of accidental hemorrhage, as compared with 41 of placenta prævia; 21 only were serious, and of these there were 5 deaths of mothers from hemorrhage, while the fœtal mortality was 66 per cent. In general the prognosis is worse both for the child and for the mother in placenta prævia.

Treatment.—In the less severe forms of open hemorrhage active interference is not indicated. The reader will find several cases of accidental hemorrhage recorded by Rigby[4] where immediate delivery was not attempted; indeed he insisted upon the different treatment to be pursued in case of accidental hemorrhage from that required when the placenta was at the mouth of the womb, in the latter urging the importance of immediate delivery. The patient will lie with her head low, her body lightly covered, and stimulants be administered as required. But if the hemorrhage be grave, whether open or concealed, prompt delivery is indicated, provided she is not so prostrate that reaction cannot be hoped for. As deep calls unto deep, so one bleeding invites another, and the final and most faithful uterine hæmostatic is uterine retraction; but such retraction is impossible while the uterus is distended by the ovum and by effused blood, and hence the practice so generally advised. Rupture of the membranes is usually the first step to be taken; it should be instantly followed by firm compression of the uterus. If the os be sufficiently dilated to admit of immediate delivery by podalic version, or by the forceps, one or the other method is indicated; but if it be undilated, artificial dilatation is required, and if it yield readily ergot may be given. In the majority of cases, according to Galabin, and especially in all milder cases, the puncture of the membranes and administration of oxytocics will be found sufficient without recourse to forceps or version.

[1] American Journal of Obstetrics, vol. ii.
[2] Goodell, op. cit.
[3] Op. cit.
[4] Op. cit.

PART III.

LABOR.

CHAPTER I.

CAUSES OF LABOR—PRECURSORY SYMPTOMS—PHYSIOLOGICAL PHENOMENA—CHANGES IN THE FORM OF THE HEAD IN VERTEX PRESENTATION—CAPUT SUCCEDANEUM.

Labor is the physiological end of pregnancy, and may be defined as the process by which the fœtus and its appendages are separated from the mother; it is travail, bringing forth. Nature's design being the continuance of the race, the fœtus must have reached such development before its expulsion that it is *viable*, that is, capable of living external to the mother. If, therefore, the product of conception be expelled before such capability, the process is not called labor but *abortion* or *miscarriage* (see page 290). If labor take place in the eighth or ninth month it is called *premature*, because the fœtus has not attained its perfect development; if labor be delayed beyond nine months, it is called *postponed*, if the fœtus be alive, but *missed* labor if it be dead. When parturition is effected by the sole power of the maternal organism it is called *natural;* but if art aid or replace that power it is termed *artificial* labor. In order that a labor may be natural the fœtus must not exceed the normal size, and the presentation must be favorable; the birth canal must be normal in size and form, and, finally, the forces, voluntary and involuntary of the mother, must be able to dilate the birth canal, to mould the presenting part, determine changes in its position so that shorter fœtal diameters are brought in relation with longer diameters of the mother's pelvis, the passenger thus accommodated to the passage, and all resistance overcome.

Determining Causes of Labor.—For a long time it was believed that the fœtus escaped from the uterus by its own efforts, just as the chick leaves its shell, or the butterfly its cocoon. Harvey, for example, held that "the fœtus, with its head downward, attacks the portals of the womb, opens them by its own energies, and thus struggles into day."

If the fœtus made its own way from the mother's womb, the question naturally arose as to the reason for its action, and various answers were given. The amniotic liquor became acrid, and irritated the skin of the fœtus; Drelincourt said that the intestine was filled with meconium, and hence a colic which disturbed the fœtus, and made it strive to get out,

while others held that a distended bladder was the cause of this effort; the womb became too hot for it, or it needed to breathe, or sought different food; Fabricius asserted that the weight of its head pressed open the mouth of the uterus. Some held that obliteration of the utero-placental vessels caused the child to leave, others that the uterus having reached a certain distension, reacted and by its contraction incommoded the fœtus; narrowing of the ductus arteriosus, of the ductus venosus, and of the foramen of Botal have also been suggested as the causes of the action of the fœtus.

Those who held that the fœtus was an active agent in parturition, asserted that the delivery of a dead child was more difficult than that of a living one. Admitting the assumption, Depaul has suggested three answers: First, the living fœtus by its movements may excite or increase uterine contractions. Second, in case the fœtus dies, some time may elapse between the death and the expulsion, but the development of the uterus ceasing with the former its action in the latter may be less powerful than it is at the time of perfect development. Third, if the membranes have been ruptured the resulting fœtal decomposition may have a poisonous influence upon the muscular fibres of the uterus weakening their action.

Post-mortem births have been claimed as proof that the fœtus could escape from the womb by its own efforts. But when these happen soon after death, they result from the persistence of uterine contractility while the resistance of soft parts is lost; occurring later, they are caused by the pressure of gases formed in the abdomen external to the uterus.

Fatty degeneration of the decidua by which the ovum is detached from the uterus and becomes a foreign body, is alleged by some to be the cause of labor. It is well known that artificial detachment of the ovum is one of the most certain methods of inducing labor. But the fatty degeneration which is supposed to excite natural labor is not a constant fact.

The influence of the ovaries in exciting labor has been maintained. Tyler Smith believed he had established that ovarian excitement is the law of parturition in all forms of ovi-expulsion; this excitement, this nisus, he alleged, is active at monthly periods through the pregnancy becoming at the tenth so great as to cause labor. Probably the majority of women are not conscious during their pregnancy of periodical ovarian disturbance; in the order of nature ovulation is then suspended, the ovaries for the time being having fulfilled their work now rest. Beside, the tenth period varies in different women, in one menstruating every thirty days it is three hundred days, while in another who has her flow every twenty days, it is only two hundred. Again, women may conceive who never menstruated, or in the physiological absence of the flow during lactation; a nisus which fails to cause menstruation in the non-pregnant state, has not enough power to start the machinery of child-birth. It is not probable that extirpation of the ovaries would prevent labor. Single ovariotomy has frequently been done during pregnancy, and labor occurred at the normal time. Quite recently double ovariotomy was done in the case of a

pregnant woman, but this did not prevent the action of the uterus in the expulsion of the ovum.

But if the determining cause of labor be not found in the fœtus or in changes in the decidua or in the ovaries, may it not be in the uterus? It is held by some that when the muscular fibres of the uterus have attained their perfect development, expulsive contractions result. But the contractile power of the uterus is manifested in premature labor and in abortion. Others teach that the uterus may be distended to a certain degree, and then reacts against the distension. But the thickness of the uterine walls is different in different subjects, and in the same subject varies in different pregnancies, yet in each case the reaction occurs just when the fœtus has reached maturity. In multiple pregnancy and also in hydramnios the uterine distension is greater than in single or in normal pregnancy.

Brown-Séquard has shown that carbonic acid circulating in increased quantity in the blood of a pregnant animal, causes uterine contractions, and the occurrence of labor is therefore attributed to the accumulation of carbonic acid in the venous apparatus of the uterus. Dr. Robert Barnes[1] has called attention to the fact that when the French army in Algeria kindled fires at the mouths of caves in which, among others, a number of pregnant women had taken refuge, almost all these women miscarried. But it is possible that mental emotion had as much to do with the accident as carbonic acid had. The carbonic acid hypothesis of the induction of labor fails, because it does not explain why the uterine muscular tissue did not act sooner, but was indifferent to the presence of carbonic acid until nine months ended, and then suddenly resented and began the process of labor.

Dubois and Depaul upheld a theory first advanced by Power in 1819. According to it, the expulsion of the fœtus is similar to that of the feces or of the urine. Feces accumulate in the rectum, and after a time by pressure on the sphincter irritate it, until reflex action determines contractions which overcome its resistance, and the bowel is emptied. So, too, the renal secretion does not at first excite vesical contractions; but when the reservoir is more or less completely filled, the fibres of the neck are stretched, causing irritation and dragging on the sphincter of the organ, and this sensation reacting upon the body contraction is excited, and its contents discharged. In pregnancy, the upper part of the uterus is developed first; "little by little the lower segment takes part in the general development of the organ, and the ovum gradually occupies a larger space in this portion; thus at the ninth month that section of the uterus adjoining the internal orifice of the neck is developed in turn, and causes stretching of the circular fibres; this purely mechanical irritation, by reflex influence, acts upon the upper part of the womb."[2]

According to Bandl, the upper portion of the cervical canal is expanded during the last months of pregnancy, so as to form with the

[1] Transactions of the American Gynecological Society, vol. i.
[2] Depaul, op. cit.

lower segment of the uterus the canal of Braun, the cervico-uterine canal. Now it follows, that when this expansion is complete, the lower pole of the ovum can descend into the canal, press upon the vaginal portion of the cervix, causing it to open, and then the pressure bears directly upon the external os uteri. Following this history of uterine development in the last months of pregnancy, we see how, step by step, the conditions, as explained by Depaul, which result in labor, are reached.

But, as frankly acknowledged by Depaul, the theory of Power fails to explain the access of labor-pains in extra-uterine pregnancy.

Some writers, plainly seeing the weakness of each of the various causes adduced as determining labor, have rested their explanation in a combination of them.[1] It is better to refer the matter to a law of the organism, a law the cause of which we do not know, for, as truly said by Foster,[2] we are utterly in the dark as to why the uterus, after remaining apparently perfectly quiescent, or with contractions so slight as to be with difficulty appreciated for months, is suddenly thrown into action, and within, it may be, a few hours gets rid of the burden it has borne with such tolerance for so long a time; indeed, none of the various hypotheses which have been put forward can be considered satisfactory.

The Efficient Causes of Labor.—The chief agent in the expulsion of the fœtus is the uterus itself. During the first part of labor the uterine contractions act unaided; but when the os uteri is dilated so as to offer little or no resistance to the descent of the part of the fœtus which presents, they are reinforced by the action of the abdominal muscles. In exceptional cases, as in complete prolapse of the uterus, or when the patient is paraplegic, or profoundly narcotized, uterine contractions have alone effected delivery, but the labor under these circumstances is longer.

Precursors of Labor.—In some cases labor begins abruptly—the patient, for example, being wakened in the night by frequent and strong uterine contractions. But in the majority a change in the form of the abdomen, increased secretion from the external organs of generation at first, and then from the glands of the neck of the uterus, swelling of the labia, and the hitherto painless contractions of pregnancy becoming more frequent and causing some discomfort, prepare the way and herald the coming of labor. The first of these phenomena is not constant; it results from the head of the fœtus covered by the inferior segment of the uterus and more or less of the expanded upper portion of the cervical canal entering the pelvic cavity, while the superior portion of the uterus inclines more in front and is lower. By this descent or settling down of the uterus—falling of the abdomen it is sometimes called—the patient's waist is not so large, her breathing is less interfered with, she can take a fuller inspiration, and her stomach relieved from pressure, receive more food; on the other hand, the in-

[1] Their explanation has always seemed to me similar to the action of the physician who combined many medicines in his prescription, "so that the disease might take whichever it liked."

[2] Text-Book of Physiology.

creased downward pressure may cause irritability of the bladder or of the rectum, difficulty in walking and greater swelling of the lower limbs. This change in the form of the abdomen is marked in the primigravida, but may fail in the multigravida, for the uterus and the abdominal wall of the latter having undergone development in one or more previous pregnancies, yield more readily, the uterus does not rise so high, and is more inclined forward earlier in pregnancy. In cases presenting this phenomenon its value as a sign of approaching labor is not great, for while it usually occurs from one to two weeks before, this interval may be only a day or two, or it may be a month. It is a favorable indication as to the labor, for it shows that the presentation is normal and the pelvis roomy.

Active hyperæmia and passive congestion, the latter resulting from pressure, cause more abundant secretion from the glands of the cervix. This discharge is viscid, yellowish, and in some cases toward the end of pregnancy contains striæ of blood; when thus stained, its color being caused in the same manner as that of the sputa in pneumonia according to Velpeau, it is known in the lying-in room as a "show," and is then usually an indication of considerable advance in labor. It is caused, whether occurring at the end of pregnancy, or in the beginning of labor, by partial detachment of the decidua near the mouth of the womb. The striæ of blood observed at the close of the stage of dilatation of the os uteri, are caused by slight lacerations of the cervix. An abundant discharge from the cervical glands is a favorable indication as to the ready dilatation of the os uteri.

The external organs of generation are swelled and moistened by their own and by the vaginal secretions. The painless uterine contractions of pregnancy become more frequent, and begin to cause more or less discomfort. In the parous especially it is not unusual for these contractions to become decidedly painful some days before labor; they may come on at night disturbing the woman's rest, and making her believe labor is at hand, but disappear in the morning to be renewed the following night. When the cervix is effaced, and uterine contractions recur at regular intervals and cause dilatation of the os uteri, labor has begun.

Stages of Labor.—Although labor is one process from the beginning to the end, yet it is usual to consider it as including three stages or periods. The first stage, the uterine period, begins with dilatation of the os uteri, and ends when that dilatation is completed so that the head, or the greater part of it, can pass through the os uteri, this being so expanded as to offer no resistance. The second stage of labor, the utero-abdominal period, then begins, and includes the expulsion of the child. The third stage, the placental period, embraces the detachment of the placenta, its expulsion from the uterus, and then from the vagina. While the boundary between the second and third stages is well marked, that between the former and the first is by no means so clear; theoretically, the line is as stated, but in practice one rarely sees it so sharply and abruptly defined—the first oftener gradually passes into the second stage.

Phenomena of Labor.—These are usually divided into *Physiological* and *Mechanical.* A third class has been added by some, and are called *Plastic Phenomena;* by these are meant the fœtal form changes produced in labor, and dependent upon presentation and position; they are the deformations which the fœtal part undergoes in its transmission through the birth canal; they disappear a few days after birth. These in relation to vertex presentations will be mentioned at the close of the present chapter, and those of other presentations will be given in connection with the mechanical phenomena of labor.

Physiological Phenomena.—First. *Uterine Contractions.*—As the contractions of the uterus are the chief power by which the fœtus and its appendages are expelled, their study is important.

Characteristics of Uterine Contractions.—First. They are *involuntary.* They are independent of the will, it can neither begin nor stop them. But though not subject to volition, they may be affected by mental impressions. Thus the presence of a person in the room of the parturient who is disagreeable to her, or for whom she has an antipathy, may interfere with their regular action and power, while they may be immediately arrested by the arrival of a stranger who takes the place of the expected family physician. Profound mental anxiety, grave apprehension of disaster, and deep sorrow may lessen the activity of uterine contractions.

Second. These contractions are *peristaltic.* Whether the uterine action begins at the fundus, passing downward, as held by many authorities, or, at the neck and extends up, as taught by some, "the separate waves of contraction succeed each other so rapidly" that the whole organ is engaged. The most probable view, derived from observations of inferior animals, is that the peristaltic movements begin at the fundus of the uterus.

Third. The contractions are *intermittent.* The periods of action and of rest are different in different times of labor. The contractions last about twenty seconds at the beginning of labor, and the intervals are twenty or thirty minutes; toward the close of the second stage of labor the former may last a minute or more, while the latter only two or three minutes, sometimes less, but during it the intervals are about five minutes. In some cases the uterus after having manifested active contractions for a few hours, pauses in its work, and a rest of some hours may follow, after which its action is resumed with new vigor. Such a pause, therefore, neither the condition of the mother nor of the child indicating the demand for interference, should not be considered pathological. The ordinary intermittence in the succession of uterine contractions is important both for the mother and for the child; the latter is saved by it from a continuous pressure which would cause asphyxia, and the former has her burden of suffering divided into many parts which can therefore be endured, while united they would be too heavy for mortal power; and beside, such continuous and concentrated action would produce injurious pressure upon her tissues, and render rupture of the uterus almost inevitable. The intermittence of uterine action corresponds with that

observed in the action of other organs, *e. g.*, the heart, the lungs, the intestines, etc., and the noblest human organ, the brain, has its period of activity followed by one of repose; alternate work and rest seem to be the law of life. The contractions do not begin and end abruptly, each gradually reaches its maximum and then declines, a climbing, and then a falling wave; but in the latter part of labor this characteristic becomes much less marked.

Fourth. The contractions of the uterus are associated with changes in its form and in its position. During a contraction the organ takes a cylindrical form; its transverse diameter is notably lessened, while both the longitudinal and the antero-posterior are slightly increased; the shortening of the transverse diameter produces some extension of the fœtus, its curved form is lessened, and hence the slight increase in the longitudinal diameter of the uterus. The broad and round ligaments contracting simultaneously with the uterus have some effect in pressing it toward the pelvis; the round ligaments by their contraction also draw the organ forward, so that the fundus rests upon the abdominal wall.

Fifth. The power of the contractions is in proportion to their frequency and the resistance; it increases with the progress of the labor, the duration of contractions being inversely proportionate to the intervals. The force and frequency of uterine contractions are not in all cases in relation with the general vigor of the subject; these contractions may be strong and frequent in feeble, delicate women, while weak, and the intervals long in the robust.

Sixth. The character of the contractions is related to the presentation. Depaul has especially drawn attention to this fact, stating that the contractions are usually more regular and effective in presentation of the vertex. Uniform pressure upon the lower uterine segment and the dilating os seems necessary in order to evoke the regular and strong action of the body and fundus of the uterus; this condition cannot be met by presentation of the face, of the breech, or of the shoulder, and hence the contractions present a manifest irregularity. The physiognomy of the labor will in most cases give a valuable indication as to the part of the fœtus which presents.

It is not uncommon to find the contractions alternating in strength, a vigorous contraction being followed by a feeble contraction, and *vice versa;* they then come in couples. One of the characteristics of uterine contractions is that they are painful, but the subject of pain in labor will be considered in another connection.

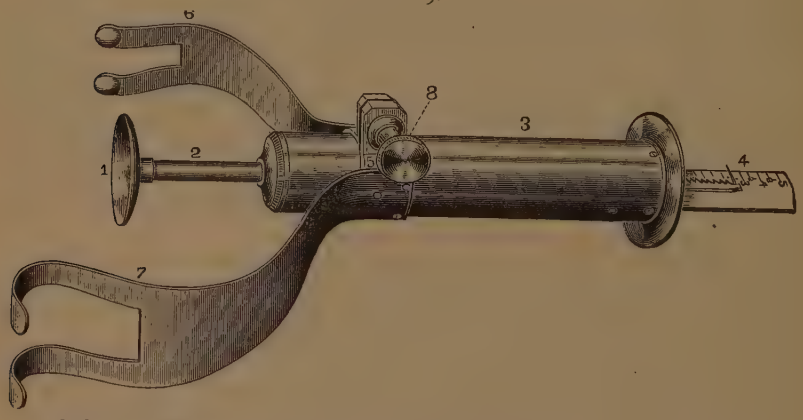
Force of Uterine Contraction.—Many endeavors have been made to ascertain the force exercised in labor. These have been by measuring the bulk and extent of the voluntary and involuntary muscles concerned in the function (*Haughton*); by determining the force necessary to rupture the fœtal membranes (*Poppel* and *Duncan*); by means of the tocodynamometer (*Schatz*); and by the tocograph (*Poullet*). Haughton's estimate was 577.75 pounds, which exceeds that quoted by Sterne in "Tristram Shandy"—"470 pounds avoirdupois acting

upon the head of the child." Poullet's conclusion[1] is that the maximum force of expulsion is about 50 pounds. Duncan states that in easy labor a force scarcely exceeding the weight of the child is necessary, while only a few difficult labors require for their whole work a force exceeding 50 pounds; and admitting the force asserted by Haughton the child would be shot out of the vagina at the rate of 36 feet per second. Schatz's estimate is from 17 to 55 pounds. Ribemont has repeated the experiments of Duncan, and has found that with the membranes presenting a surface of 10 centimetres, the pressure necessary to rupture them was 10 kilo. 660; the maximum, 11 kilo. 179. Spiegelberg regarded all estimates as liable to errors—*e.g.*, that derived from the resistance of the fœtal membranes in labor to this, that the water in front of the presenting head is not subjected to the same pressure as the other uterine contents, while the manometric method is liable to mistakes in measurement. It cannot, therefore, be claimed that we know the entire force, or that which is its chief element, the contraction of the uterus as exerted in labor.

Dr. Henry Leaman showed to the Philadelphia County Medical Society, January, 1885, an instrument of his invention, to which he gave the name of parturiometer. The following is his description of it:—

It consists essentially of a metallic cylinder, in which is placed a spring accurately made to measure weight in pounds. The pressure impinges on a socket, and is conveyed to the spring by a plunger; at the other end of the cylinder is a self-registering indicator and scale. The socket is placed

FIG. 109.



1. Socket. 2. Plunger. 3. Cylinder with spring. 4. Scale and indicator. 5. Movable Band. 6. Short arm. 7. Long arm. 8. Screw.

in contact with the advancing part of the ovum, or fœtus, during an interval between pains. The effective movement of the mass is indicated on the scale during the uterine contraction. The instrument is held in posi-

[1] Poullet (Archives de Tocologie, 1880) refers to Tristram Shandy as an English author, and speaks of Professor Haughton as "one of his compatriots," a ludicrous mistake, into which more recently Delore and Lutaud (Traité Pratique de l'Art des Accouchements, Paris, 1883) have been led.

tion by the band and arms, which are movable by means of a screw. The anterior, or short arm, rests between the labia, against the arch of the pubes, the posterior on the coccyx. The socket can be placed inside of the cervix, in contact with the membranes; or, if the membranes are broken, against the advancing part of the fœtus, before full dilatation of the cervix. It can be used at the superior strait with ease. In the various conditions in which it has been employed, its registration has corresponded with experience, and rendered observation more accurate.

The parturiometer indicates when it is proper to break the membranes; when the cervix is fully dilated; when the application of instruments becomes necessary. By observing, in cases when the resistance is nil or at a minimum, and then again when it is at a maximum, the amount of force lost may thus be arrived at. Also, by close observation we may finally arrive at the separation of the true uterine force as distinct from anything else, and thus a more accurate knowledge of the physiological action of the uterus be obtained. This instrument promises to render the attendance of labor cases more exact and scientific.[1]

Dr. Leaman has been kind enough to furnish me with the following statement as to the practical application of his instrument:—

Observations which have been made on the expulsive force of the uterus embrace three stages in delivery, viz., the force required to overcome the resistance in succession of the cervix, the pelvis, and perineum. The parturiometer applied to the membranes within the cervix gives a marking of from one to three pounds. In one case the membranes ruptured while the gauge was applied, and the marking on the scale was three pounds. In another case, where the pains were regular, good, and frequent, the os remained dilated to the size of one and a half inches in diameter during a period of nine hours without perceptible change. During this time the gauge was applied a number of times. The highest marking during contraction was one pound; frequently there was no perceptible indication by the instrument. Believing from these experiments that the uterine force was impeded by over-distension, I ruptured the membranes, and in one hour the child was born. The os being fully dilated, and not till then, does the fœtus impinge upon the pelvic walls. The first case in which I made use of this instrument was one where the first two children had been still-born, with use of the forceps. The vertex was in the first position, and the head at the superior strait. The parturiometer was applied to the vertex, and the marking did not exceed at any time one and three-fourths pounds. These experiments, together with the previous history, determined the speedy use of the forceps, with a living child as the result.

In one case where the occiput was right posterior, the os being fully dilated, the gauge registered one and three-fourths pounds. At the expiration of three hours the gauge recorded the same as before, and there being no apparent advance the child was delivered with forceps. In all cases where the pressure at this stage did not exceed two or two and a half pounds, the forceps has been found necessary.

During dilatation of the perineum the pressure may be as high as five pounds and over. These observations seem to point to the opinion that the uterine force is a definite quantity within a normal physiological range not yet determined. The pounds-pressure on the gauge is the difference

[1] College and Clinical Record.

between this definite quantity and the resistance. The resistance being great the gauge marks low, and *vice versa*.

Dr. Leaman has been working at one of the most important practical problems in obstetrics, but how much he has contributed to its solution by his ingenious invention and interesting observations remains to be established.

Abdominal Contractions.—When the mouth of the womb is so dilated as to offer little or no resistance to the escape of the presenting part, the first stage of labor ends, and the second, or the utero-abdominal period, begins. The uterine contractions are now reinforced by voluntary contractions of the muscles of the abdomen. Preparing for one of these efforts, the patient bends forward, fixes her body by pressing the feet against a firm object, possibly grasps the bed or another's hands, takes a deep inspiration, pushing the diaphragm down, and the glottis is closed; the muscles are now firmly contracted, thus lessening the size of the cavity. The pressure from this contraction is exerted uniformly upon the contents; it is resisted above by the depressed diaphragm, and behind by the immovable spine; it acts uniformly upon the uterus, forcing it downward, and is transmitted to its contents. This force not only assists that of the uterus, but also acts as a counter-force to uterine contractions, which, when violent, might, were this absent, cause rupture of the vagina at its uterine attachment.

While, during the greater part of the second stage of labor, the action of the abdominal muscles is voluntary, it generally happens that towards its close, just when the fœtal head is about to be expelled from the vulva, the patient cannot refrain effort, and the hitherto voluntary action becomes purely reflex.

The Third Stage.—In ten to twenty minutes after the birth of the child uterine retraction, which detaches, and then uterine contractions, which expel the placenta into the vagina, occur; they may be assisted by voluntary contraction. So, too, these uterine and abdominal contractions, assisted in some slight degree by the elasticity and contractions of the vagina, may thrust the placenta without. This topic will be considered more fully hereafter.

Pain.—Labor begins, continues, and ends with pain; "child-birth is the only necessarily and invariably painful function of the species." While in very rare cases delivery is without suffering, yet these are exceptional, for now, as of old, the law is "in sorrow thou shalt bring forth children." But pain is relative; there is no measure of this phenomenon of vital sense which can be universally applied. One patient will be in restless agony in child-birth, vexing the air with her out-cries, while another lies comparatively quiet, and suffers in silence, because sensation, power of endurance, and force of will so greatly differ. Nevertheless, pain is not so great in the parous as in the primipara; yet how often the former will declare that they suffer more in the present than in a previous labor, simply because of that beneficent law of the economy which leads human beings to forget painful sensations. The occurrence of pains during uterine action in labor is so

constant that the name is generally, and in almost all languages, used as a synonym for uterine contractions. But the duration of a contraction and of a pain is not the same; while the former causes the latter, the contraction can be readily recognized by the obstetrician with his hand upon the patient's abdomen, or with his finger at the os uteri, before she complains of any suffering, and he likewise knows by the same means that it continues after all complaint has ceased; pain comes after contraction begins, and goes before it ends.

Character of the Pains.—In the beginning of labor these are felt as a disagreeable pressure downward in the pelvis, later they are felt in the lumbar and sacral region, radiating thence to the pubes so that the patient is girdled with pain. At first they do not by their frequency or their severity hinder a patient's being engaged in such occupations as reading, sewing, conversing, etc., only when one occurs she pauses for a minute or two, a slight change of expression is noticed, a mere cloud passes over her face, she bends her body forward during the brief suffering, and then resumes her conversation, reading, or work. The bending forward is instinctive, and is said to be an effort to withdraw the ovum from pressing directly upon the lower segment of the uterus, but it is probable that the movement is made in response to the anterior and downward positional change of the uterus, caused by the contraction of the broad and round ligaments, and to lessen the pressure upon the abdominal wall, just as more common abdominal pain leads to a similar movement.

During the first stage of labor the pains are spoken of by the sufferer as "cutting," "grinding," etc., but by the obstetrician as dilating, or preparatory. As the frequency and intensity of the uterine contractions increase so do the pains increase in severity; the patient may become restless, irritable, despondent, and discouraged, asserting that she suffers in vain, "the pains do no good," "the child will never be born," and she knows she will die. After a time, when the os has become fully dilated, and the birth canal is thus prepared for the descent of the child, expulsive, or "bearing-down," pains occur. The transition is not sudden but gradual, the call for voluntary effort is at first indistinct, and partly from this, and partly because the patient fears lest such effort may add to her suffering, the response begins in a hesitating, tentative way, and then gradually becomes equal to the demand. Hitherto the patient has been without power to assist the progress of labor—she has had only to endure, to suffer—but with the establishment of the second stage active duty devolves on her, and she usually becomes hopeful and resolute; no longer moaning and groaning, her lips are closed while voluntary abdominal pressure combines with uterine contraction to drive the fœtus down the birth canal, abrupt expiration occurs at the close of a pain, with a sudden and guttural outcry. The practitioner soon learns to know by a patient's cry whether she is in the first or second stage of labor.

The Seat of Pain.—Madame Boivin, who knew from personal experience the suffering of childbirth, thought the pain was almost entirely the result of the stretching of the os uteri. Depaul said that in the first stage of labor it was in the lateral and lower parts of the uterus,

but afterward it arose from pressure of the fœtus upon the organs and tissues of the pelvic cavity. According to Spiegelberg, form-changes in the uterus and of separate muscular fasciculi in its walls, permitting pressure on nerves are causes of suffering. The pressure upon the tissues surrounding the vulvar orifice made during its dilatation also causes severe pain.

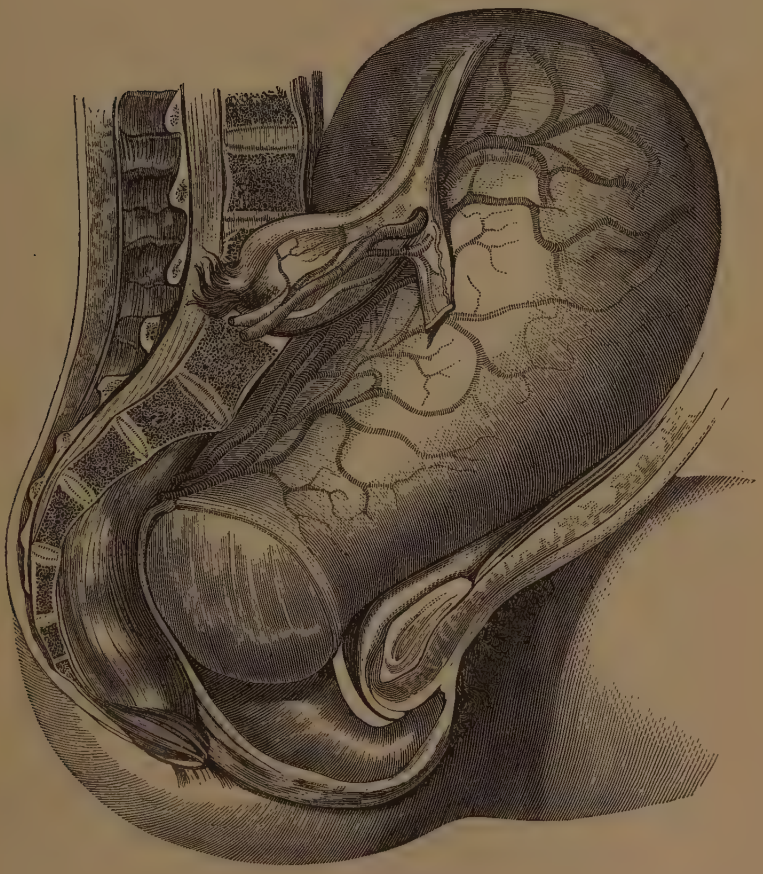
Dilatation of the Os Uteri.—At the beginning of labor the cervix has disappeared, only a slightly projecting border—more pronounced in multiparæ—marking the boundary of the os uteri. This is the first barrier to the escape of the fœtus, and dilatation of the os, therefore, is the first part of labor. This dilatation is at once active and passive; the muscular fibres of the body and the fundus overcome the resistance of the circular fibres of the os, and the pressure of the ovum upon the os, made by the projecting membranes filled with amniotic liquor—the bag of waters—mechanically dilates it. Further, this uniform pressure of the ovum upon the lower segment and mouth of the womb evokes regular and stronger contractions from the body and fundus; and thus, in addition to its mechanical dilatation, assists labor. When the uterus contracts the cavity lessens, its walls tend to approach a common centre; but the ovum resists, and the resultant of the forces developed by the contracting muscular fasciculi is transmitted in the direction of least resistance, that is, to the os uteri, from which a part of the ovum, this part increasing with the progress of the labor, can protrude. As the os uteri expands, the cavity lessens; and the former, by the contraction of the longitudinal fibres of the uterus tends to ascend, drawn up over the ovum or the presenting part. At the beginning of a contraction, the rim of the os uteri becomes thicker, irregular, as if "puckered," and the opening smaller, but with the progress of the uterine effort the border becomes thin, regular, uniform in thickness, and the opening expands; with the advance of the labor the lessening of the os at the beginning of a contraction is not observed, but dilatation alone.

In primiparæ the border of the os uteri is at the beginning of labor very thin, scarcely thicker than parchment, is closely applied to the fœtal head, and during a uterine contraction seems like a tense cord; but with the progress of the labor it becomes thicker and swelled, especially at the anterior part, and it is more dilatable; it never, however, becomes as thin as it was at first.

The dilatation rapidly increases with the progress of the labor, nearly as much time being needed for the os to be expanded to the size of a silver dollar, as from this to reach complete expansion. The process is more rapid in the parous than in the primipara. At the beginning of labor the os is usually posterior, and to the left; but with its progress it comes nearer the centre; its form is at first circular, then oval, the large end of the oval being to the left, and somewhat behind. The posterior lip generally yields before the anterior, the uterine orifice being nearer to the sacrum than it is to the pubes; if the labor be prolonged, the anterior lip in most cases becomes œdematous.

The Bag of Waters.—The ovum being equally pressed at all points except at the os uteri projects there, and that portion of the membranes containing amniotic liquor thus protruding, "making a hernia through the more or less dilated os," is the bag of waters. The size and form of this protrusion are usually dependent upon the degree of dilatation, and upon the presentation. When the os is but slightly dilated, the bag of waters is small; so, too, in vertex presentation it is at first quite small, and has the form of a watch crystal, but as the dilatation approaches completion it increases, and is hemispherical. The bag is large in presentation of the face, of the breech, or of the shoulder, because no one of these parts can be adapted to the cer-

FIG. 110.



THE BAG OF WATERS.

vico-uterine canal, but permits the amniotic liquor to pass freely by it; the great size of the bag of waters rather than the form is an indication of an unfavorable presentation, especially when this is observed during the dilatation of the os uteri, and the presenting part of the

fœtus does not readily descend. A double bag of waters is observed in some cases of twin pregnancy.

The pouch is smooth and tense during uterine contractions, relaxed and yielding in the intervals. Tarnier's experiments have proved that the membranes are permeable by fluids, so that a moist condition of the vagina is not a proof of rupture of the amniotic sac. The bag of waters acts as a hydrostatic dilator of the os uteri, the best and the least painful one; and therefore care must be taken to guard against its premature rupture. In some cases rupture takes place before labor, or as the first indication that labor has begun, the patient being wakened from her sleep in the night by a gush of water; this accident is more frequent in primigravidæ than in multigravidæ, because in the former the uterine walls are more resisting, and yield less readily to distension. When the waters are evacuated before or at the beginning of uterine contractions, the labor is called a dry labor, and the first stage is generally quite tedious.

A collection of fluid between the ovum and the uterus, or between the amnion and the chorion may take place, and its discharge simulate that of the amniotic liquor; when this occurs the flow is known as the "false waters,"[1] and probably most of the cases in which it is thought that the ovum was ruptured some time before labor are thus explained. This last statement, however, does not apply to all, for there are authentic cases where the rupture took place some weeks before labor. Poullet, quoted by Tarnier, gives one instance of rupture six weeks, another nine weeks before labor, and then a living fœtus being born in each case. Matthews Duncan mentions an instance in which the pregnancy continued forty-five days after the first discharge of amniotic fluid; he also states that a medical friend, mistaking pregnancy for an ovarian dropsy, performed paracentesis, drawing off a large quantity of amniotic liquor, when he desisted because feeling the fœtus strike against the canula, and yet the pregnancy did not end for a month. If one is in doubt whether the fluid discharged in a given case be liquor amnii and enough of it can be collected for examination, the presence or absence of sebaceous matter promptly settles the question.

In rare instances, less rare in premature than in mature labor, the ovum is expelled entire. Under these circumstances the membranes were known as a child's *caul*, and once were in demand by sailors as an amulet which would keep its possessor from drowning. Formerly when the child was born with a flap of membranes covering the head, the fact was regarded as a favorable augury.

The bag of waters is usually spontaneously ruptured about the time the os uteri is fully dilated; in some cases, however, it may protrude from the vulvar orifice before being torn. As a rule, the rent is at the most dependent part of the pouch, and the water escapes suddenly and with noise, but it may be above in the cervico-uterine canal, and the flow is gradual and silent, while the part of the membranes in front of the child's head being entire still forms a pouch. The quantity of fluid discharged depends upon the presentation; thus

[1] These discharges are generally caused by catarrhal endometritis. See p. 274.

if the vertex present, the head makes a ball-valve which, when pressed down during a uterine contraction entirely arrests the flow, and permits only a slight discharge in the interval; no other part of the fœtal ovoid which may present can so well fill the cervico-uterine canal, but by its irregular form readily permits the escape of the amniotic liquor. It is often observed in vertex presentations that when the head has descended so that partial deflexion—a movement which some authors describe in the mechanism of labor as *levelling*—can take place there is an increased flow of liquor amnii, because the neck does not completely fill the canal.

It is very important for the obstetrician to know whether the membranes are ruptured. Generally there is no difficulty in deciding this question, but cases occasionally occur when it is very great, and some deplorable mistakes have been made; thus the forceps has been applied to the fœtal head inclosed in the membranes, the distended bladder has been thought the bag of waters and incised, causing a vesico-vaginal fistula, and the fœtal scalp similarly mistaken and treated in like manner, the incision being the starting point of a fatal erysipelas. A knowledge of the fact that such errors have occurred and hence the possibility of their repetition, may prove a warning against the hurried and imperfect examination in which they originate. In doubtful cases the obstetrician should examine during a pain—of course taking care to avoid rupture of the pouch if it be present—for, however closely the membranes may be applied to the head when the uterus is at rest, there will then always be found some fluid interposed which causes their projection. In the interval between pains, the membranes are flaccid, and the finger can press them in wrinkles or folds which give a different sensation from that caused by directly touching the fœtal scalp. Finally, Charpentier advises carrying the finger as far as possible between the head of the fœtus and the cervix, thus opening a way by which, if the membranes have been ruptured, the liquor amnii will flow down into the palm of the hand.

Muco-Sanguineous Discharge.—A greater discharge from the external genital organs and from the vagina are observed toward the close of pregnancy, but with the beginning of labor an increased secretion from the glands of the cervix occurs. The character of the latter, as well as the significance of the blood often found mixed with it, have already been stated; the discharge of any considerable amount of blood with it would indicate most probably either a serious rent of the cervix or a partial detachment of the placenta.

Dilatation of the Vagina.—The upper part of the vagina was dilated by the descent of the lower portion of the uterus containing the fœtal head, and by the stretching of the margin of the os uteri, so that there is formed a complete utero-vaginal canal ample for the passage of the head; no resistance is presented until the inferior boundary of the vagina is reached; in primiparæ the hymen is an obstacle which is removed by a series of rents. Budin has shown that the vaginal orifice may present a resistance lasting some hours, which has been commonly attributed to the perineum; in one case marked by this delay,

he incised the vaginal orifice, and the labor ended rapidly without injury to the perineum or to the vulva.

Dilatation of the Vulva.—The head now enters the vulvar canal, the perineum is behind, the labia at its sides, and the uterine contractions, whose force is increased with the partial emptying of the uterus, and the abdominal, which are stronger from reflex irritation caused by the head pressing on the perineum, drive the presenting part like a wedge, widely separating the vulvar walls. The perineum is greatly elongated, and so thinned that the bones of the fœtal head may be felt through it; it is converted into a gutter, externally from side to side, and from before backward; its elastic tissue and muscles direct the head upward.

FIG. 111.

HEAD AT THE VULVAR OPENING.[1]

Each pain pushes the head further, but it recedes in the interval between pains—the parts are stretched, and then relaxed; the anus is drawn wide open, and the anterior wall of the rectum exposed, making a part of the external covering of the fœtal head; the labia are separated by the head, more and more of this emerging at each contraction, which seems as if it were to be the last needed for its expulsion, until finally the parietal protuberances escape the rima of the vulva, and there is no more recession, for the bearing-down effort seems almost continuous, scarcely a pause for breath, until in a conquering

[1] "In this figure, copied from Smellie, the child's head, *a*, is seen separating the labia; the extension, thinning, and protrusion of the perineum, *b*, caused by the head's descent, and called by some the *perineal tumor*, are also well portrayed; *d* marks the point of the coccyx; *c* the anus dilated, so that the inner membrane of the rectum is to some extent exposed to the contact of the hand, when applied for the protection of the structures. This exposure is not injurious; no harm arises from it; and sometimes it is even greater than is represented here." Ramsbotham.

agony and with the most intense suffering the head is born. A brief pause follows, and returning pains expel the body of the child; immediately following it the remaining portion of the liquor amnii, frequently some blood from a partially detached placenta with it, is discharged.

Expulsion of the Placenta.—The third stage of labor, the discharge of the placenta, usually follows within twenty minutes after the end of the second stage. The separation of the placenta from the uterus is caused, as taught by Jacquemier, by the retraction of the latter, and it is probable that this separation begins neither at the margin of the placenta, as some authorities assert, nor at the centre, as claimed by others, but is general, or at least, as stated by Ribemont-Dessaignes,[1] almost simultaneous in all parts. After the placenta has been detached uterine contractions expel it into the vagina. Observers do not agree as to the part of the placenta which presents at the os uteri, some insisting that it is most frequently the margin, or some part in its vicinity, being folded upon its fœtal surface, while others find that the fœtal surface descends first, and that the membranes are inverted. In the annexed figure the mode in which the placenta usually presents according to Matthews Duncan is given. Pinard found in 60 cases the placenta presented by its fœtal surface 51 times, by its uterine surface in 2 cases, and by its fœtal border only 7 times. Ribemont-Dessaignes in 17 cases observed presentation of the fœtal surface 12 times, of the border 4 times, and of the uterine surface once. This question must be determined by new observations; it is probable that the part which presents depends upon the part of the uterus to which the placenta was attached, and upon whether the membranes are separated before the uterine contractions which expel it begin. Some clots of blood are usually discharged with it; the uterine bloodvessels torn in its detachment are kept from bleeding chiefly by contraction of the middle muscular coat of the uterus, thus furnishing, according to the happy expression of Pinard, a thousand living ligatures for vessels that otherwise would pour out blood into the uterine cavity.

FIG. 112.

MODE IN WHICH THE PLACENTA IS NATURALLY EXPELLED. (Duncan.)

False Pains.—It sometimes happens that women during the latter part of pregnancy have what are called "false labor-pains." These have been attributed to rheumatism of the womb, to local uterine contractions, to contractions of the abdominal muscles, and to intestinal irritation. The last is probably the most frequent cause. False are distinguished from true pains by their not having been preceded by the premonitory symptoms of labor; by their situation, for they are not felt in the back, and from it extending in front, but in the abdomen, sometimes in one, and again in another part of it; by their

[1] De la Délivrance par Tractions, et par Expression, Paris, 1883.

being irregular in recurrence, not increasing in severity, and not causing any change in the os uteri. On the other hand, labor has begun when general contractions of the womb and progressive dilatation of its mouth occur.

The Effects of Labor upon the Mother.—Parturition has an influence upon various functions of the maternal organism. The desire for food is lessened or lost; it is not unusual for nausea and vomiting to occur, especially toward the end of the first stage, and these are thought to facilitate dilatation of the mouth of the womb, a common belief being that sick labors are easy labors. But while this gastric disturbance is regarded a good omen in the first stage, a very different character belongs to the vomiting which may occur in the second stage, with cessation of labor activity, and with exhaustion of the patient; the symptom is then dangerous, and immediate delivery is required. The pulse increases in frequency during a uterine contraction, lessening at its close; as this contraction drives much of the blood from the uterus into the general circulation, arterial tension is greater. Increased arterial tension and nervous irritation cause a greater secretion of urine; at first this fluid has a less specific gravity than normal, but afterward the quantity of salts is greater. A slight shivering is observed in some patients at the beginning of each contraction. The respirations less frequent during a pain, are more frequent during an interval; the temperature of the body, as well as that of the uterus, is slightly increased.

In the second stage the face is usually red and swelled, and it, and also the body and limbs, are bathed with perspiration. Patients in the absence of pains frequently are drowsy and disposed to sleep, this condition resulting in part from fatigue and in part from cerebral congestion. In labor some women are irritable, restless, and lose all self-control; but the majority pass through the terrible ordeal with patience and resignation, if not always with hope. A woman loses in labor one-ninth of her weight; the amount of loss is somewhat less in the primiparous than in the parous; the loss is of course chiefly due to the removal of the ovum, but the increased quantity of urine secreted, the perspiration, and the blood discharged with the placenta, contribute to it.

The Effects of Labor upon the Fœtus.—Uterine contractions cause temporary modifications in the fœtal circulation;[1] at the beginning of a contraction there is a slight acceleration in the pulsations of the fœtal heart, then these become slower when the contraction is strong; and, finally, when the tension of the uterus lessens, the double pulsations increase in order to resume their ordinary rhythm. The slowing of the fœtal heart during a contraction of the uterus is probably due to slight asphyxia from partial interruption of the placental circulation; it has also been attributed to greater intra-cardiac pressure, and to compression of the head. Pressure upon the fœtus may cause evacuation of the bladder, or of the rectum; discharge of meconium is common in presentation of the breech. If the placental circulation be

[1] Depaul.

interrupted, and hence the fœtus threatened with asphyxia, instinctive efforts to respire by the lungs are made. When the child is still unborn, if air enter its respiratory organs, it may cry, and to this cry the name of vagitus intra-uterinus has been given. The fact has been attested by reputable observers, but of course is exceedingly rare.

Duration of Labor.—This varies with race, climate, place, and manner of living, heredity, age, organization, physical conformation, and whether first or subsequent labor, and with the sex, presentation, and position of the child. Labor is said to be shorter in warm than in cold climates, in savage than in civilized races, in women in the country, accustomed to plain food, out-door exercise, and regular hours of rest, than in those leading opposite lives in the city. In primiparæ labor is longer than in multiparæ; it is longer also in face or breech than in vertex presentations, in occipito-posterior than in occipito-anterior positions, with male than with female children.

In primiparæ the usual period of labor is, according to Depaul, fifteen to twenty hours, but, according to Tarnier, twelve to fifteen hours; in multiparæ six to eight hours. Hecker and Ahlfeld state that the average duration of labor in primiparæ, thirty years old and more, is twenty-one to twenty-seven hours; Dieterlen's study of labor in 2369 primiparæ, the delivery being natural, shows that up to thirty-five years the duration varies but little, and is fifteen to sixteen hours, but that from thirty-five it rapidly increases, so that in primiparæ above forty-one years it is thirty-three hours. The average of all labors is, according to Nægele, twelve to fifteen hours. The second stage of labor is generally one-third that of the first. The majority of labors begin between nine and twelve P. M. and end between nine P. M. and nine A. M.

Plastic Phenomena of Labor in Vertex Presentations.—By these phenomena are meant, not only, as previously stated, the changes in the form of the cranium caused by labor, but also the production of the caput succedaneum. The head delivered in an occipito-anterior position presents a cylindrical form; the occipito-frontal and occipito-mental diameters are lessened, but the maximum diameter is increased; the subocciptio-bregmatic, the bitemporal, and the bi-parietal diameters are lessened. According[1] to Dohrn there is an asymmetry of the two lateral halves of the cranium, marked by the prominence of one of the parietal bones, and by the flattening of the other, which is sometimes pushed farther in front, sometimes farther back than the one on the opposite side, so that the parietal protuberances are not equidistant from the occipital protuberance. In occipito-sacral delivery the head has the appearance of being drawn out vertically from below above; the vertex makes a conical projection, so that the head has the form of a sugar-loaf. The forehead and the anterior part of the parietal bones are almost upon the same vertical plane; the occiput is flattened and pushed in front.

Caput Succedaneum.—This is the name given to a tumor composed of a sero-sanguineous infiltration of the connective tissue, situated upon the presenting part of the fœtus. The swelling occurs upon that part

[1] Tarnier.

which is not subjected to pressure. "In the course of labor,[1] after the evacuation of the liquor amnii, the child is during pains subjected to strong pressure from the parturient forces, and equally strong counter-pressure from the resisting maternal passages. Every part of the child is subjected to these forces, except that adjacent to the as yet undilated passage through which the child is being urged."

The caput succedaneum does not fluctuate, pits on pressure, and is violet-colored. The longer and more difficult the labor, the larger this swelling. By some it has been improperly termed cephalhæmatoma; Bouchut describes it under the name of supra-periosteal cephalhæmatoma, or pseudo-cephalhæmatoma. The former is the name given to an effusion of blood between the periosteum and the bone; it is more frequently found upon the right than upon the left parietal bone, in some cases upon both, in others upon the occipital, upon the temporal, or upon the frontal. The affection rarely occurs. Bouchut[2] describes it as an indolent, distinctly-circumscribed, soft, and fluctuating tumor, and attended by no discoloration of the skin; it may be as large as a pullet's egg. The severity or great length of the labor has no influence upon its production. There may be felt in many cases a bony circle at its base separating it from adjacent parts.

In left occipito-anterior position the caput succedaneum is upon the posterior and superior angle of the right parietal bone. In left occipito-posterior position, it occupies the superior and anterior angle of the right parietal bone. In right occipito-anterior position the caput succedaneum is at the posterior and superior angle of the left parietal; and in right occipito-posterior position, at the superior and anterior angle of the same bone. If in consequence of slight resistance the labor be very rapid, no caput succedaneum may be formed.

After the head has descended to the pelvic floor, and anterior rotatation occurred if delivery be delayed, a secondary caput succedaneum will be formed; but this will be always in the median line, and not limited to one of the parietal bones.

[1] Duncan. [2] Op. cit.

CHAPTER II.

THE MECHANICAL PHENOMENA OF LABOR.

The mechanical phenomena of labor are the passive movements given the fœtus in its expulsion. These phenomena are included under the general term mechanism of labor. The efficient cause of labor is the force of uterine and of abdominal contractions; the final cause, that is, the design, is birth; but the former in accomplishing this end must act by material and formal causes. Now the material cause is the fœtus and the birth-canal, and the formal cause includes the adaptations of the former to the latter, adaptations by which its transmission is rendered possible. Certain diameters of the fœtal head are greater than any of the pelvic diameters, and hence if the former be brought in relation with the latter, the further movement of the fœtus is impossible. The birth-canal presents an axis of emergence almost perpendicular to the axis of entrance, and therefore the fœtus going in to that canal in one direction, must take another and very different direction in order to pass out. The longest diameter of the pelvic inlet is an oblique diameter, while that of the outlet is antero-posterior; hence a diameter of the fœtal head, which requires the space given by the former for its transmission, will, when it descends to the outlet, need to be placed in relation with the latter in order that it can pass out. One word explains these various passive movements of the fœtus in birth, and that is *accommodation;* during the whole process of delivery there must be adaptations and correspondences between the passenger and the passage through which it is transmitted.

It will be seen in the study of the mechanism of labor that there is a unity of character in all labors, no matter what the presentation or position of the fœtus; provided the labor be natural, occurring at term and the fœtus be living, there is but one mechanism.[1]

Before studying the mechanical phenomena of parturition a few words must be said in regard to presentation and position. As has been before stated, presentation is that part of the fœtus which is in relation with the pelvic inlet—that which presents, offers to the examining finger at the mouth of the womb, or that part through which the pelvic axis passes—and our first inquiry is as to the number of presentations. Baudelocque described twenty-three, making for these ninety-four positions; but it is fortunate for medical students that authorities do not follow him in this. Madame Lachapelle was the first to show that the fœtus presented by the cephalic, or the pelvic extremity, or by the trunk. But these presentations which are appa-

[1] Pajot.

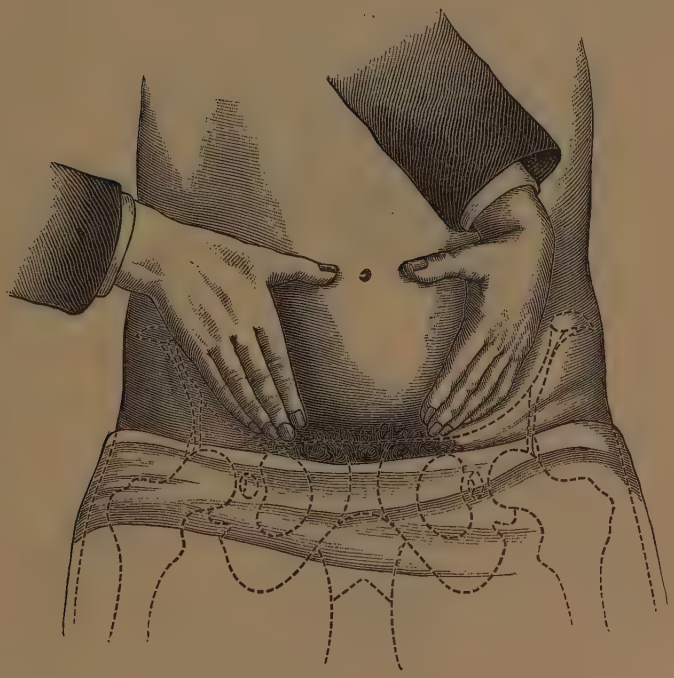
rently three, really include five. The fœtal ovoid usually corresponds with the uterine ovoid; that is, the fœtus occupies a longitudinal situation in the womb, and hence one or the other end of this ovoid, generally the head, is at the pelvic inlet. If the head be inclined forward with reference to the trunk, that is, flexion be present, and this is the case generally, the vertex—summit or top of the head—presents, and hence the presentation is cranial. On the other hand, if deflexion—bending back of the head, extension—has occurred, the face presents, and the presentation is called by this name or facial. The pelvis of the fœtus may be in the lower segment of the womb, and then the presentation is pelvic. This presentation is not changed by any change of position of the lower limbs; the pelvic wedge may be complete or decomposed—a knee or foot, both knees or both feet,[1] may come first, but no matter what changes of position of these parts, none of the mechanical phenomena of labor are needed to adapt them to the birth-canal, for they are small and the space offered by the maternal pelvis is relatively large; and on the other hand such changes, such mechanism are required for the expulsion of the breech. Those parts, therefore, are included under pelvic presentation, which may be defined as embracing all that part of the fœtus below a horizontal line passing from one to the other iliac crest. The fœtus lying transversely, or nearly so, may present some part of the body at the inlet; but the tendency in all cases is for one or the other shoulder to descend first, so that presentation of the body becomes that of the right, or that of the left shoulder. We thus have five presentations, cranial, or vertex, facial, pelvic, right and left shoulder. The relations which the presenting part of the fœtus has to certain fixed points of the inlet give the position. For most obstetricians these points are the sacro-iliac joints and the ilio-pectineal eminences; they are the terminations of the oblique diameters of the inlet. It follows, therefore, as some selected point of reference for each presentation is in relation with one of these four points of the mother's pelvis, sometimes called the cardinal points of Capuron, the position is determined, and that there are four positions. The latter part of this statement, however, only applies to the first three presentations; each shoulder presentation has only two positions, but this will be explained hereafter.

It is important that the student should have clearly fixed in his mind the essential difference between presentation and position, never confounding them, never using one as a synonym for the other. Presentation means an object, position, a relation; the former is a part

[1] Those born with the feet first were called *Agrippas*. Roederer, *Elementa Artis Obstetriciæ*, observes: Quando fœtus pedes primi ad orificium decidunt, *partus agripparum* oritur. In Pliny's Natural History, Book Seventh, the following passage is found: In pedes procedere nascentem, contra naturam est: quo argumento eos appellavere Agrippas, ut ægre partos. This explanation of the origin of the term has been accepted in the New Sydenham Society's Lexicon. But a more probable origin is given by Kraus, *Kritisch-etymologisches medicinisches Lexikon;* agrippa is from αγριος ιππος, feminine αγρια ιππα, for the nomadic tribes being more familiar with parturition as it occurred in mares, gave this name to children born with the feet first. According to Schroeder there was a superstition that those born thus would be injurious to themselves and to society, and in confirmation of the belief the examples of Agrippa, Nero, Richard III., and Louis XV., were cited.

of the fœtus, the latter a temporary relation of that part to the mother's pelvis; position is an accident, the property of a presentation, belonging to it, while the reverse can never be true. Further, it is important not to confound position as belonging to presentation with position as belonging to the fœtus. The fœtus is said to be in a longitudinal or a transverse position in the uterine cavity; but this use of the word is very different from that in connection with presentation. The four positions belonging to each of the three presentations—cranial, facial, and pelvic—are generally designated first, second, third, and fourth. Their relative frequency is not settled—at least all authorities do not agree—and, therefore, the fitness of the term is questionable; but as the mechanism of labor presents some slight differences according as the point of reference of the presenting part is in the right or left side of the mother's pelvis, and, as to whether it is anterior or posterior, these positions will be distinguished as right and left anterior, and right and left posterior. In vertex or cranial presentation, for illustration, this point of reference is the occiput, so that the four positions for this

FIG. 113.



ASCERTAINING THE PRESENCE OF THE FŒTAL HEAD IN LOWER PART OF UTERUS.

presentation are left occipito-anterior, left occipito-posterior, right occipito-anterior, and right occipito-posterior.

Diagnosis.—The diagnosis of presentation and position is made by auscultation, abdominal palpation, and vaginal touch. The first two are most useful in pregnancy, the last in labor; the former cannot be made during uterine contraction, and the third, if then made, the membranes being unruptured, must be done with great care to avoid their rupture. Nevertheless, it is held that the practitioner who makes himself expert in obstetric palpation and auscultation, can reduce to a minimum vaginal examinations, thus lessening the liability to septic infection.

Vertex Presentation—Diagnosis.—The vertex presents, according to Naegele, in 93 to 95 per cent., according to Spiegelberg, in 97 per cent. of all cases; the causes of this great frequency have been stated. In making a diagnosis by external examination the practitioner should first ascertain that the fœtus is not placed transversely, but occupies a longitudinal situation in the womb—the fœtal thus corresponding with the uterine ovoid. He learns this by observing the general form of the abdomen, and by his being able in palpation to circumscribe with his hand the fundus of the uterus in its normal position. The next step is to find which end of the fœtal ovoid is in the lower segment of the uterus. In doing this the obstetrician places his hands extended and flat upon the lower part of the sides of the abdomen, pressing them somewhat downward at the ulnar border within the iliac fossæ;

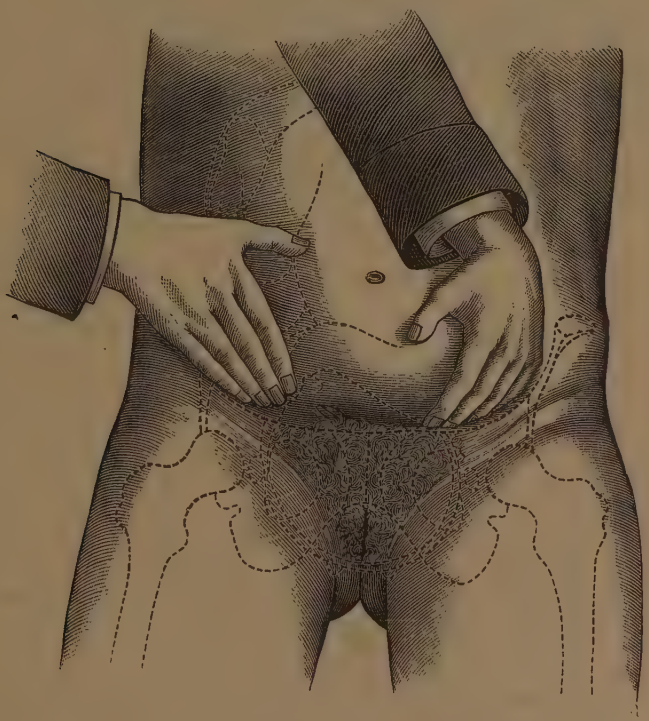
FIG. 114.

A METHOD OF APPLYING THE HANDS AT THE BEGINNING OF ABDOMINAL PALPATION.

then the hands still pressed downward and moved toward each other, will include the fœtal head if it be in the lower part of the uterus, and if it has not entered the pelvic cavity. Instead of at first placing the hands upon the sides of the uterus, they may be in

contact with each other directly in the median line of the uterine globe just above the pubes (Fig. 114), then gradually separated, pressing the ulnar edge of each downward upon the abdominal wall in this movement until they pass deeper when they reach the borders of the uterus, and the lower portion of this organ is then included between them. This manipulation, it should be observed, is of chief value in the diagnosis of pregnancy. A single hand may often be successfully used in abdominal palpation in order to determine that the fœtal head is in the lower part of the uterus. The distinguishing marks of the fœtal head in palpation are, its uniformity of shape, roundness, hardness, and mobility; if the head be in the pelvic cavity, the characteristic last stated fails. The fact that the presenting part is in the pelvic cavity in the latter part of pregnancy, or early in labor, is a strong proof that the presentation is neither the pelvis nor the face, but the vertex. Further, in this situation one hand can be carried deeper into the pelvis, while the hand on the other side of the pelvis meets with resistance (Fig. 115); the occiput therefore is upon the one side,

FIG. 115.



PALPATION WHEN THE FŒTAL HEAD IS IN THE PELVIS.

the forehead upon the other, and the former being more deeply situated allows the descent of the hand, while the latter prevents such penetration. Further, when the occiput is found the position of the back is

known, for it must be upon the same side as the occiput. The practitioner may then verify his diagnosis by exploring the fundus of the uterus where the pelvis of the fœtus must necessarily be. This part of the child is recognized as a large, firm, and somewhat round body, but it lacks the uniform shape, the solidity and the mobility of the head; moreover, there will be found near it small movable bodies, parts of one or both lower limbs. The means by which a vertex is distinguished from a face presentation will be given when the latter is considered.

Auscultation.—If the pulsations of the fœtal heart are heard most distinctly below the transverse line (see Fig. 96), the head is most probably in the lower part of the uterus, and when heard to the left of the median line, the occiput is in the left side of the mother's pelvis, but if upon the right, the occiput is in the right side.

Internal Examination.—The method of vaginal examination has been given on pages 182–3–4. Again, let the practitioner be cautioned against the danger of rupturing the membranes by pressure upon the bag during a uterine contraction; he should, therefore, usually defer exploration of the presenting part until the contraction ceases. If the head has descended into the pelvic cavity, the finger touches a round, hard, projecting body, and the margin of the mouth of the womb. If the head be high up, only a small portion of the cranial vault is accessible to the finger, but a larger portion may be reached if the other hand is used to press firmly upon the hypogastrium so as to force the head further into the pelvis. When the os is dilated the bones may be plainly felt through the fœtal membranes, and during a contraction the wrinkling of the scalp, and the overriding of the bones. If labor has been in progress some time, a large soft mass, the *caput succedaneum*, may conceal the cranial bones; but by pressing firmly upon this mass, it is possible the finger may detect beneath it a bony surface, or else the finger should be passed within the os so as to touch parts above the swelling.

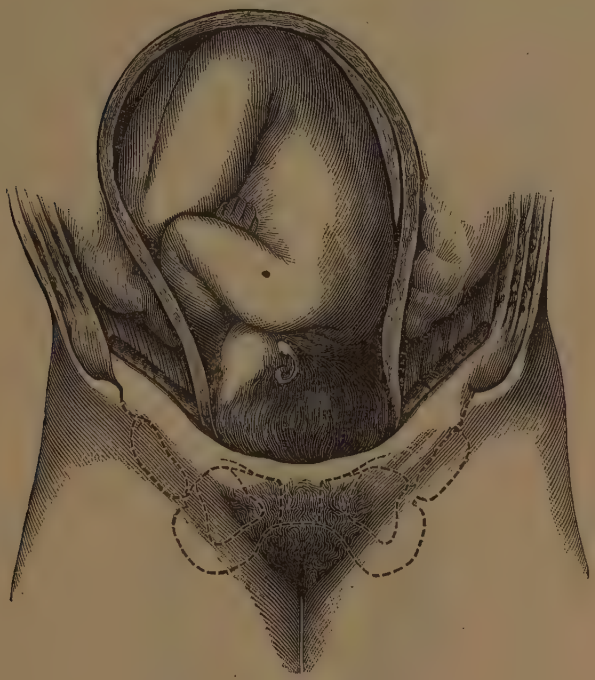
Positions.—Having ascertained that the presentation is cranial, the position is next to be ascertained. The occiput being the point of reference, in this presentation, the question is as to its relation to some one of the cardinal points of the inlet. If it is directed toward the left ilio-pectineal eminence, the position is left occipito-anterior; if to the right, right occipito-anterior; if to the left sacro-iliac joint, left occipito-posterior, but if to the right, right occipito-posterior.

The same means are available for the diagnosis of position, as were for that of presentation, viz., abdominal palpation, auscultation, and vaginal touch. The application of these means will be considered with each of the four positions given, following the diagnosis with a description of the mechanism of labor.

First. Left Occipito-anterior Position (Figs. 116, 117).—Ascertaining that the back of the child is upon the left side of the mother's abdomen, we know that the occiput is anterior or posterior to the left side of the pelvic; and if the resistance given by the back lessens as the hand is carried farther to the left side, the occiput, of course which is in the line of greatest resistance, points to the ilio-pectineal eminence—that is, the position is left occipito-anterior.

Upon auscultation the maximum of intensity of the fœtal heart-sounds is found about the middle of a line passing from the left ilio-

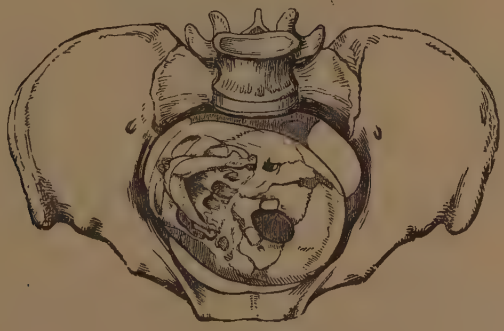
FIG. 116.



LEFT OCCIPITO-ANTERIOR POSITION.

pectineal eminence to the umbilicus; some, however, have the line start from the left anterior spinous process of the ilium.

FIG. 117.



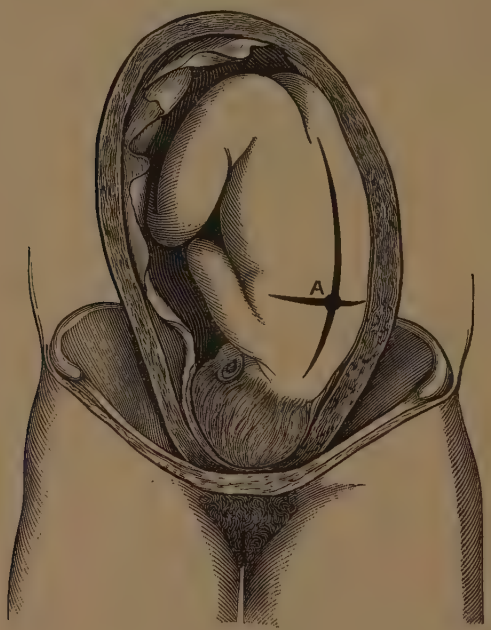
FIRST CRANIAL POSITION.—Occiput at the left ilio-pectineal eminence, forehead at the right sacro-iliac joint.

By vaginal touch the sagittal suture is usually felt crossing the pelvic area obliquely, though it may be transverse, and a little nearer

the promontory than it is to the pubic joint. Having found the suture, the finger follows it either to the right or to the left until the anterior or posterior fontanelle is felt. The anterior fontanelle is upon the right side of the mother's pelvis, and necessarily the occiput is upon the opposite side. If the finger follows the course of the sagittal suture to the posterior fontanelle, the place rather than the presence of the latter is recognized by its being at the apex of a depressed triangle, two sides of which are made by the margins of the parietal bones overriding the occipital bone, these sides corresponding with the bifurcation of the sagittal suture. The occiput is beyond, at, or near the left ilio-pectineal eminence. This position, left occipito-anterior, has been generally called the first, and it is the first in frequency, occurring in about seventy per cent.

Mechanism of Labor.—In studying this mechanism it is convenient to divide it into stages, or times; but it is to be remembered that this division is arbitrary, for some of these stages may occur cotemporaneously, or some may be absent, but in such cases the necessity for

FIG. 118.

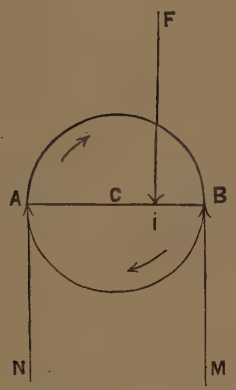


PLACE OF GREATEST INTENSITY OF FŒTAL HEART-SOUNDS IN LEFT OCCIPITO-ANTERIOR POSITION.

them does not exist, the factors causing them are absent. These different stages are, in presentation of the vertex, first, flexion; second, descent, also called engagement, or progression; third, rotation; fourth, extension; fifth, external rotation of the head with internal rotation of the body; and, sixth, delivery of the body. Each of these mechanical phenomena is to be studied as to its causes, its effects, and its diagnosis.

Flexion.—This is bending the chin toward the chest so that it rests on it when flexion is complete; it is essentially rotation of the head upon a transverse axis. In considering the causes of flexion the natural position of the head must be regarded as predisposing to this purely passive movement, for it is already somewhat flexed, and the flexion occurring in labor is simply an increase in this state. It has been taught by some that the articulation of the head with the vertebral column being nearer the occiput than it is to the forehead, the force passing through that column acts with greater power upon the occiput, causing it to descend while the forehead rises, and thus flexion is increased. But as long as the fœtus is inclosed in the membranes direct pressure on it does not occur; uterine contractions compress the ovum at all points equally, save at the lower segment of the uterus and the os uteri, which are dilated by the pressure, and the force is transmitted to the fœtus through the intervening liquor amnii. Even after the rupture of the membranes the fœtal head may so effectually plug the cervico-uterine canal that only a small quantity of amniotic liquor escapes, and therefore direct pressure of the fundus of the uterus upon the upper portion of the fœtal ovoid fails. It therefore follows

FIG. 119.



EQUAL RESISTING FORCES ACTING THROUGH LEVERS OF UNEQUAL LENGTH.

FIG. 120.

ILLUSTRATING THE DIFFERENT LENGTHS OF THE FRONTAL ARM *F B*, AND THE OCCIPITAL ARM *B O*, OF THE LEVER MADE BY THE FŒTAL HEAD.

that the direction of the uterine force cannot be determined by pressure of the fundus immediately upon the fœtus in the first stage of labor, or, indeed, subsequently before the free discharge of the amniotic liquor.

The most generally received explanation of this phenomenon of labor is that it results from the unequal lengths of the two arms of a lever represented by the head, for that part of the head in front of the vertebral articulation presents a

greater surface than that behind this articulation; in other words, the anterior arm of the lever is longer than the posterior—that is, the distance from the occipital foramen to the forehead is greater than from the occipital foramen to the occiput. Hence, equal resistance applied to these two arms necessarily causes the anterior or longer arm to rise, the posterior or shorter to descend.

In the subjoined diagram (Fig. 119), taken from Hubert, let the line *F i* represent the active force; *N A* and *M B*, equal resistances; the short arm of the lever, *A B*, that is *E i*, must descend, for the resistance, *NA*, is the more powerful, because acting through the long arm, *A i*.

Fig. 120, taken from Ribemont, shows the much greater length of the anterior than of the posterior arm of the lever represented by the head; *F B* is the frontal, and *B O* the occipital arm; the sum of resistance pressure to which the former is subjected must much exceed that which opposes the descent of the latter.

Another principle in mechanics has been brought forward by Hubert as contributing to flexion. If a propulsive force be exercised centrally upon a mobile, and there be resisting forces not directly opposite to each other, but at different levels, rotation of the mobile occurs; thus, flexion of the head, which, as has been before stated, is simply rotation of the head upon a transverse axis, is frequently completed when the os uteri is almost entirely dilated so that the occiput has escaped, and the resistance of the os acts upon the forehead and the face, causing flexion.

According to Lahs[1] the entire expulsive force of the uterus acts upon the fœtal head in a line perpendicular to the surface of what he terms "the girdle of contact," that is, the part of the birth-canal for the time resisting the advance of the head. "The head is a wedge, whose surfaces are found through the tangents made on those points of the head's surface directly in relation with the girdle of contact." That part of the head whose tangent makes the smaller angle with the perpendicular line of expulsion must descend first. This smaller angle is made at the occiput, and therefore this descends and flexion results.

Whatever theory may be adopted of flexion, the movement itself is essentially one of accommodation, of adaptation of the fœtal head to its passage through the birth canal. The head entered the inlet with the occiput at the left ilio-pectineal eminence, and the forehead at the right sacro-iliac joint, that is, the occipito-frontal diameter was in relation with the right oblique of the inlet, and the bi-parietal with the left oblique; hence a circumference of the fœtal head whose diameter is the occipito-frontal is in relation with the circumference of the inlet. The long diameter is not perpendicular, but oblique to the plane of the inlet; beside this obliquity it was asserted by Naegele that the head entered inclined on the anterior parietal bone, so that the right parietal protuberance was somewhat lower than the left, and this inclination was known as Naegele's obliquity, but most obstetricians reject it; at least its consideration may well be omitted in the study of the mechanism of normal labor. The effect of flexion is not only to bring

[1] Die Theorie der Geburt.

the long diameter of the fœtal head more or less completely in correspondence with the axis of the inlet, but to present a less circumference of the head to the circumference of the inlet, for as the chin comes to the sternum, not the occipito-frontal diameter, but a shorter one, the suboccipito-bregmatic, is in relation with the left oblique of the inlet. Remembering that flexion is a movement of accommodation, it occurs when and where such accommodation is necessary. It may, therefore, take place at the inlet, in the lower segment of the uterus, or at the perineal floor, or, finally, it may not occur because the small size of the fœtus, or the great size of the pelvis, the slight resistance of the os uteri, or of the pelvic floor renders it unnecessary.

Flexion not only substitutes a less fœtal head plane, but, according to Pajot,[1] prior to its occurrence there is a great loss of force from its transmission through a flexible, vacillating rod, to which he compares the fœtus, the mobility existing especially at the articulation of the head with the trunk; but when the head is firmly pressed upon the thorax it is found favorably disposed to participate in the impulsion impressed upon the general mass of the fœtus. Further, flexion facilitates moulding of the head so that it is adapted to the birth canal. The diagnosis of flexion simply depends upon the recognition of the place occupied by each of the fontanelles; at the beginning of labor the fontanelles are almost upon the same plane, the anterior a little higher than the posterior; as flexion occurs, the former recedes with the ascent of the forehead, but the latter descends with the descent of the occiput, and "when the anterior is very high, and consequently the posterior very low, flexion is complete," but if the two are equally accessible, it has not occurred.

Descent.—The uterine, reinforced by abdominal, contractions now compel the head to descend into the pelvic cavity; the axis of the uterus corresponding with that of the upper part of this cavity there is no loss of force, and hence if there be the proper relation between the fœtal head and the canal, the latter presenting only its usual resistance, and the driving force normal, there is no delay in the descent of the head. The head planes are parallel with the pelvic planes during the first part of the descent, and then in consequence of the greater resistance of the posterior than of the anterior pelvic wall this *synclitism*—that is, the parallelism between the planes of the child's head and the transverse planes of the mother's pelvis—ceases, though Dr. Hodge and some other obstetricians held that it continued during the entire descent.

A movement called *levelling* is described by some as occurring when the head has descended so that the occiput is at the lower margin of the ischio-pubic foramen, and the bregma is at the second bone of the sacrum; by this movement, essentially a lessening of flexion, the anterior fontanelle becomes more accessible, and the occipito-frontal diameter is in relation with the right oblique of the pelvic canal. This phenomenon is not constant, does not contribute when present to the progress of labor, and therefore may be dismissed from further consideration.

[1] Dictionnaire Encyclopédique des Sciences Médicales.

The progress of the second stage of labor is ascertained by measuring with the finger the distance of the head from the vulvar opening. This measurement is most conveniently made by using the thumb as an index to the measuring rod, the finger. Two errors are to be guarded against: First, mistaking a caput succedaneum for advance of the head; and, second, the head may descend still inclosed in the uterus whose lower segment may be so thinned that without great care the examiner believes he directly touches the head, and may conclude that the labor is much further advanced than it really is.

Rotation.—This is a movement by which the occiput turns in front, the entire trunk participating in the rotation. The expulsive power driving the head down, the occiput is forced to escape, but only anteriorly is there a gap in the pelvic wall, and to this gap the ischio-pubic ramus—bevelled, flaring—seems to invite; the occiput descends with a pain, boring, feeling its way, receding in the interval between pains, until finally driven by a vigorous pain it passes the bony margin at the latero-anterior part of the pelvis, and there is no subsequent recession, but it sweeps forward toward the centre of the vulvar opening, and the sub-occipital region comes under the pubic symphysis. As observed by Dr. Ritchie,[1] in some cases the head escapes all pivot movement in the pelvis, but comes down obliquely upon the perineum, and suddenly wheels round when it is on the point of escaping from the vulva, the rotation resulting from the shape of the perineum which, attached on either side, yields most in the median line, thus forming a gutter in which the head is best accommodated, lying not obliquely but antero-posteriorly. When rotation of the head occurs in the pelvic cavity, while the occiput comes in front, there is a reverse movement of the sinciput which turns into the sacral cavity.

Obstetric authorities have devoted much attention to the study of the causes of rotation, and have greatly differed as to them. Baudelocque referred this phenomenon to the inclined planes of the pelvis, the anterior determining rotation into the pubic arch, the posterior rotation into the sacral cavity. This view probably has had more adherents than any presented since it; some have modified it by changing the position of the arbitrary lines, separating the anterior from the posterior planes, but still essentially their teaching has been that of Baudelocque; this was true especially of the teaching of Hodge. But the accepted explanation of the cause of rotation, while satisfactory so far as anterior positions of the occiput is concerned, failed as to posterior positions, for in these, too, as first proved by Naegele, the occiput in most cases rotates anteriorly. Perineal resistance, according to some, is the cause of anterior rotation; but, as observed by Charpentier, this cannot be the sole cause, or the movement ought never to fail in primiparæ, for in them the perineum is remarkably resistant. The unequal lengths of the two arms of the head lever is, according to others, the cause, for the occipital arm being the shorter the occiput moves in the direction of least resistance.

The law of mechanics, which Hubert has applied to the explana-

[1] Medical Times and Gazette, 1865.

tion of flexion, has its application here also. When a mobile is subjected to resisting forces, which are not directly opposite, they tend to impress upon it a movement of rotation. While some assert that this explanation holds only for the rotation which occurs in anterior positions, it may be shown in the discussion of the mechanism of labor in posterior positions the anterior rotation which then occurs can also be thus explained. Pajot, rejecting all geometric explanations, finds the just idea of the causes of rotation in the immutable principle of mechanics which has been formulated in what is known as Pajot's law (see page 146). "The indispensable condition for the execution of this law is that the power, the volume of the content, and the capacity of the container must be proportional." If the fœtus be too large, insurmountable obstacles are presented to its rotation; if it be too small, there is no invitation to turn, and when the fœtus and the passage are in due proportion, turning may fail for want of sufficient expulsive force. The results of rotation are that the suboccipito-bregmatic diameter which corresponded with the right oblique of the mother's pelvis, is now in relation with the antero-posterior of the outlet, and the bi-parietal with the transverse, and the shoulders—as the body participated in the rotation—descend in the pelvis with the bisacromial diameter in relation with its transverse diameter. Rotation is known to have taken place by the position in which the occiput is found, that is directly in front; in some cases the movement may be recognized during its occurrence by a finger placed upon the occiput.

Extension.—The third of the mechanical phenomena of labor is a movement of the head directly the reverse of the first; whereas the head then rotated forward on its transverse axis so that the chin came to rest on the sternum, it now rotates backward, and the chin recedes from the sternum, that is, deflexion or extension occurs. In this movement the nape of the neck presses the subpubic ligament, the shoulders are transverse, and close behind the pubic arch so that the occiput can advance no farther in a direct line; meanwhile expulsive action continuing is met by the resistance of the perineum, and the resultant diagonal force is in the axis of the prolonged birth canal; the expulsive force cannot act directly upon the occiput, but only upon the long arm of the head lever thus forcing the chin to descend; according to Pajot the occipito-mental diameter represents a lever of the third order, the fulcrum being at the pubic arch, the resistance at the pelvic floor, and the power between the two, that is, at the occipital foramen. But extension or rotation backward of the fœtal head, may also be explained as the result of a driving force met by two resisting forces acting upon the fœtal head at different planes, or two unequal forces, even if acting in the same plane. We have first the driving force of uterine and abdominal contractions; the perineum resists, and there is also resistance at the pubic arch, but the former resistance being less than the latter rotation results—the head is rolled out of the vulvar opening, the bregma, the forehead, and the face appearing successively from behind the perineum, the occiput continuing to move in a curve over the pubic symphysis, the successive radii of this curve being the several sub-

occipital diameters. The longest of these diameters is the suboccipito-frontal, and the vulvar opening is of course in greatest danger of being torn during the passage of the head circumference corresponding with this diameter. The progress of this stage of labor is known by the emergence of a greater part of the fœtal head at each expulsive effort, and its completion by the dropping down of the head in front of the anus, and by the retraction of the perineum.

FIG. 121.

DIAGRAMMATIC REPRESENTATION OF SUCCESSIVE STAGES OF THE FIRST POSITION.

External Rotation of the Head with Internal Rotation of the Body.—In some cases just after the head drops down—face below, occiput above—there is a change of the head to an oblique position: this movement is called *restitution*, and it takes place when in internal rotation the body did not follow the head in this movement, but a twist in the neck occurred, and now the head is *restored* to its normal position with reference to the trunk. Restitution is oftener seen in occipito-posterior than in occipito-anterior positions, but even in the former it is not frequent, for with perfect flexion the fœtus is so compacted together that head and trunk make one mass, and move together. In most cases no such movement as restitution is recognized, but the head remains motionless after dropping down with the end of the fourth stage of labor, until a new expulsive effort occurs, and then it moves through the fourth of a circle so that the occiput points to the mother's left thigh, and the face to her right thigh. A simple law may be given in this connection—the occiput always points to that thigh corresponding to the side of the pelvis in which it was before the delivery of the head, and thus if the occiput was in the left side of the

pelvis, no matter whether posterior or anterior, it will point to the left thigh. The external rotation of the head indicates the internal rotation of the shoulders; they descended into the pelvis, the bisacromial diameter in relation with the left oblique of the inlet; the body rotating with the head the bisacromial became transverse, but as delivery in this position is impossible, body rotation, which is indicated by external rotation of the head, takes place so that the right shoulder is behind the pubic joint, and the left is in the sacral cavity.

Expulsion of the Body.—Expulsive efforts continuing, the pubic shoulder passes out first—it has the shorter distance to traverse, and it represents the occiput which was delivered first—and the superior part of the trunk pivots upon the arm just below the shoulder, while the sacral shoulder sweeps the sacral curve, and follows the course of

FIG. 122.

EXTERNAL ROTATION OF HEAD IN FIRST POSITION.

the distended perineum, the perineal pressure and the direction of the canal causing incurvation of the body upon its lateral plane; the sacral shoulder is finally delivered, and the arm quickly follows, and then the pubic arm passes out, and the lateral curvature of the body is at an end. Just as the nape of the neck was fixed at the subpubic ligament in delivery of the head, so is the upper part of the pubic arm situated in delivery of the superior portion of the trunk; delivery of the head was effected through extension, but that of the shoulders by flexion, the lateral incurvation of the body is simply the analogue of extension of the head.

Authorities differ as to which shoulder is delivered first, and some end the controversy by asserting a simultaneous delivery. The illustration just presented, shows that the upper shoulder has passed the pubic arch, while the under one is still hidden by the perineum; although Dr. Hodge, from whose work the diagram is taken, taught that they escaped at the same time, the statement is contradicted by it. Cazeaux held that in primiparæ the delivery is as stated in the text, but not in the parous when the perineum has been torn. But this is a concession of the very point at issue, and we may say with Pajot that in the normal mechanism of labor the pubic shoulder is first delivered.

The expulsion of the rest of the body rapidly follows that of the shoulders, the trunk making somewhat of a spiral movement; if the hips are very large there may be some delay, and the same mechanism occurs as in the delivery of the shoulders.

Right Occipito-anterior Position.—In this position, which is the rarest of the four, the occiput is in the inlet, at the right ilio-pectineal eminence, and the forehead at the left sacro-iliac joint, the child's back is in the right and anterior portion of the uterus, and the limbs in the left and posterior portion. By abdominal palpation the head is found in the lower segment of the uterus, and the back in the situation mentioned; the hand passes more deeply in the pelvis upon the right side than upon the left. Upon auscultation, the maximum of intensity of the fœtal heart sounds is found, according to Depaul, at the middle of a line passing from the right ilio-pectineal eminence to the umbilicus (see Fig. 96; this maximum is found at *C*), but according to Ribemont upon the median line, sometimes, indeed, a little to the left of it. Digital examination confirms the diagnosis of a vertex presentation, and the sagittal suture is found to be in the right oblique diameter of the inlet, the occiput at the right ilio-pectineal eminence, and the forehead at the left sacro-iliac joint.

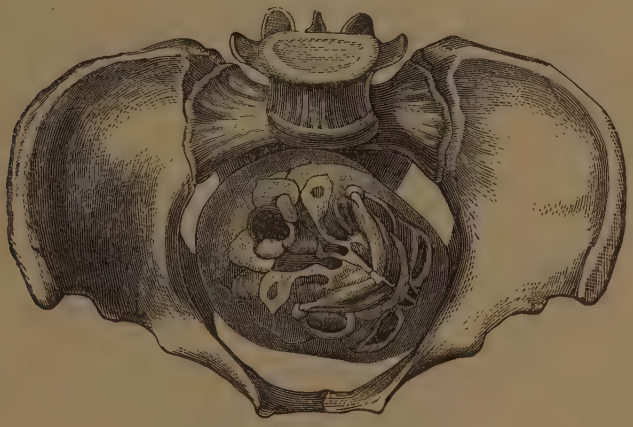
The mechanical phenomena are the same as those which have been described as occurring in a left occipito-anterior position. First, flexion occurs, a process of accommodation, an adaptation of the presenting part to the birth-canal, by substituting a smaller head circumference to the pelvic area, a lessening of the fœtal part which descends first. Descent follows, and then rotation; but the occiput, instead of rotating from left to right, now rotates from right to left into the pubic arch. Extension occurs next, for direct progression of the occiput is impossible, because it is held back by the shoulders lying transversely, but indirect advance occurs by the occiput tending to approach the back, the chin departing from the chest, and the entire head is rolled out of the vulvar opening; the head thus rotates backward upon its transverse axis in deflexion, just as it rotated forward in flexion. After the birth of the head it rotates externally as the sign and the effect of internal rotation of the body, but the occiput now is directed to the mother's right thigh, the face to her left, which is the reverse of the situation of these parts of the head in a left occipital position. By the direction in which this external rotation occurs the student may correct or confirm the diagnosis of position made at the beginning of labor. Finally, delivery of the body takes place in the manner described for a left occipito-anterior position.

Right Occipito-posterior Position.—This is next in frequency to the position first described; it is that position reversed, and hence the occipito-frontal and the bi-parietal diameters hold the same relations to the two oblique diameters of the inlet that they did in left occipito-anterior position. The former of these fœtal diameters, which it will be remembered is the longer, avoids the left oblique of the inlet, which is practically the shorter of the two pelvic measurements, because of the presence of the rectum upon the left side. The occiput is at the right sacro-iliac joint, and the forehead at the left ilio-pectineal emi-

nence; the back of the child is posterior and to the right, the limbs anterior and to the left side of the mother's abdomen.

Palpation proves the presence of the head in the lower part of the uterus; the hand can pass more deeply in the right side of the pelvis than in the left; in the latter it is arrested by the projecting forehead at the ilio-pectineal eminence. The dorsal plane of the fœtus can be

FIG. 123.



RIGHT OCCIPITO.—Posterior position.

more readily recognized if the woman lies upon her left side. The maximum of intensity for the fœtal heart-sounds is in a line passing from the right sacro-iliac joint to the umbilicus. Digital examination shows that the anterior fontanelle is in front and to the left, the posterior fontanelle to the right and behind, while the sagittal suture is in the right oblique of the inlet.

The mechanical phenomena of labor are in almost all cases the same as have been described, and therefore need not be detailed. One of these, however, requires special study—that of internal rotation. In occipito-anterior positions the occiput rotated only through a little more than one-eighth of a circle in order to be placed in the pubic arch, but now it must rotate through three-eighths. Moreover, it sometimes happens that the shoulders do not rotate at all, or only partially, and hence there results greater or less torsion of the neck, this torsion being proved by the movement of restitution immediately following the delivery of the head.

It is natural to ask why the occiput when in this position, so near the sacral cavity, does not, as the forehead did, rotate, when in a somewhat similar location, into that cavity, instead of by a much longer course seek the pubic arch. Dr. Hodge's answer was that the promontory of the sacrum determines the whole head toward the anterior part of the pelvis, and that when the point of the occiput strikes upon the spinous process of the ischium, rotation upon the right anterior inclined plane necessarily occurs, but if the point of the occiput strikes

posteriorly to this process, rotation into the hollow of the sacrum follows.

But the most satisfactory answer to the question as to the anterior rotation of the occiput, and the posterior rotation of the sinciput, is, as stated by Dr. Ritchie, that in both anterior and posterior positions the former is lower than the latter when resistance begins; in occipito-anterior positions that resistance from the pelvic floor begins when the occiput is level with the pubic arch, and the forehead with the cavity of the sacrum, but in occipito-posterior positions the resistance begins when the occiput is past the sacral cavity, and the forehead too high for the pubic arch. There are forces of resistance presented to a progressing mobile at different levels, and consequently they cause it to rotate, the most prominent or advanced part of that mobile moving in the line of least resistance.

In the further consideration of this mechanical phenomenon we must bear in mind that unchangeable law which compels in all vertex deliveries, whether artificial or natural, the occiput to pass out first. When the flexion is perfect, the head and neck make, with the upper part of the thorax, according to the comparison of Dubois, a stiff, inflexible rod. If the occiput rotates into the pubic arch, the neck more than measuring the length of the pubic joint the occiput can pass out, and extension of the head occur, and thus the rod becomes flexible, and the trunk does not enter the pelvic cavity until the head is being delivered. But the condition is very different in an occipito-posterior position; the neck is much shorter than the lateral wall of the pelvis with which it is in relation, and hence the greatest diameter of the rod, the dorso-frontal, must enter the pelvic inlet, so as to be in relation with its right oblique diameter. But the descending back, curved and projecting, cannot rest upon the promontory of the sacrum, and hence there is a force of resistance which tends to throw the presenting part from an oblique to a transverse position. This change is possible only when flexion is perfect—that is, when the chin is so firmly pressed upon the chest that the head and upper part of the trunk make a unit, and thus a movement communicated to the trunk also causes the head to move. Meantime, on the other side of the pelvis the forehead is not adapted to the pubic arch, is resisted more by the anterior than by the lateral pelvic wall; thus the two resisting forces determine rotation of the head from an oblique to a transverse position, and then the rotation is continued until the position becomes right occipito-anterior, from which the occiput finally turns into the pubic arch.

In rare cases—probably once in fifty, *Stoltz;* twice in fifty, *Uvedale West*—the occiput fails to rotate anteriorly, but turns to the sacral cavity, and the head is in an occipito-sacral instead of an occipito-pubic position. If this posterior rotation occurs, the head descends in the axis of the pelvis; but the occiput is not adapted to the concavity of the sacrum, nor the forehead to the pubic arch, so that both in front and behind space is lost. The straight, rigid rod cannot become flexible until the occiput has traversed the sacral cavity and the inner surface of the perineum, so as to pass out over its anterior margin; but this end is not possible until the trunk has also entered the pelvic

cavity, for the longest diameter of the head is less than the distance from the inlet to the vulvar opening. When the occiput escapes, the nape of the neck pivots on the anterior margin of the perineum, the occiput passing backward—extension occurring in like manner to that observed in an occipito-anterior delivery—and the anterior fontanelle, the forehead, and the face are successively delivered, all the diameters being sub-occipital, just as in an occipito-anterior delivery.

FIG. 124.

OCCIPITO-SACRAL AND PERINEAL DELIVERY.

After the head is delivered it drops down, and then follow in order external rotation of the head with internal rotation of the body, and delivery of the body. It is plain that the labor is slower in an occipito-posterior delivery, not only from the great distance the occiput must pass before it can escape from the vulvar opening, but also from the difficulties in that passage; the suffering of the woman is greater, and there is more danger that the perineum will be torn. The child is born alive if it is not large and the pelvis is normal; but if the latter be small, or the former large, still-birth is common.

In very rare cases, where the fœtal head was small, conversion of a vertex into a face presentation has occurred at the inferior strait, extension taking place, so that the chin instead of being born last is born first, emerging at the pubic symphysis, and the delivery of the head takes place by flexion.

It is unnecessary to give the diagnosis and describe the mechanism of labor in left occipito-posterior position, for they can be readily understood from the explanations already made, substituting left for right

in the description of the diagnosis and the mechanism of right occipito-posterior position.

In concluding this exposition of the mechanical phenomena of labor in vertex presentation, it must be remembered they all concur to one end, the expulsion of the child, and therefore if one or another is not needed for this end, it may be absent. In the main they are processes of adaptation, of accommodation of the fœtal head and body to the birth-canal, and are the results of a driving, and of resisting forces, hence varying as these forces vary. In some cases the fœtal head may be so small, or the mother's pelvis so large, that any increase in the head flexion is not needed for descent, flexion being essentially a lessening of size by placing a smaller head plane in relation with a greater pelvic plane; or, again, internal rotation of the head may not occur, and the head be born in the same oblique position which it had upon entering the inlet. These and other variations in the mechanism of labor are not, as Pajot well says, violations of law, but occur because some of the factors which carry out the law may be absent, or others have more power. The phenomena as described always occur if the fœtal head, the birth-canal, and the driving force are normal. If, in a given case, two of these phenomena are simultaneous, it does not follow that their individuality as to causes, results, and diagnosis is lost, and that they should be regarded as a single event.

Presentation of the Face.—In order that the face may present, the head must be extended instead of flexed, the occiput bearing the same relation to the back that the chin does to the sternum in vertex presentation.

Frequency and Causes.—Authorities differ as to the frequency of presentation of the face: 1 in 324, Spiegelberg; 1 in 231, Churchill; 1 in 217, Lachapelle; 1 in 247, Pinard; 1 in 175, Depaul; 1 in 276, Galabin; 1 in 250 or 300 cases, Hodge.

Winckel has stated that thirty-three different causes have been suggested. One of the most remarkable was that given by Osiander, viz., that the fœtus inherited a disposition from its parents to carry the head back. Hodge[1] regarded the best hypothesis that such presentation resulted from the spontaneous motions of the child, the head being fixed in this unusual posture by contractions of the uterus. Hecker regarded dolicocephalia as a cause. According to him the greater

[1] Dr. Meigs said "that dead and half-putrid children, in whose tissues there is scarcely any resiliency or resisting power left, are not so unapt to come face foremost as living children, in whom departure of the chin from the breast occasions such a great extension of the head as to be painful, whence the living child instinctively opposes the wrong tendency, by acting with all its strength to get the chin back, or the head flexed again." The statement by Dr. Meigs, and also that by Dr. Hodge, suggests a voluntary movement of the fœtal head in the one case causing and in the other preventing presentation of the face, that probably is not unquestionable. Sir Thomas Browne, whose *Religio Medici* all doctors read, among his many other literary works wrote a supposed dialogue between twins in the uterus, which unfortunately has been lost. Imagining a conversation under such circumstances is of course a very wide step beyond, but is in the same direction as the voluntary movements that have been suggested. Those who have observed how utterly powerless the new-born are to move the head in any direction, and that it falls inert according to gravitation, will hardly admit that the fœtus can, against the force of gravitation, raise the head a single inch from the chest, or that when it is removed from the chest by external causes that the fœtus, though "acting with all its strength," can replace it if the slightest force opposes.

projection of the occiput in the dolicocephalic increased the length of the posterior arm of the head lever, so that when uterine contractions occurred it ascended, while the frontal arm descended. The answer generally made by obstetricians to this explanation is that dolicocephalia is a consequence of the delivery in a face presentation, not the cause of such presentation, and that it disappears a few days after birth; further, even if this condition be present, the increase in the length of the occipital is never so great as to make it longer than the frontal arm. Spiegelberg met with a case of face presentation in a fœtus having hydrothorax. Other instances are mentioned where tumors of the neck were the cause. But apart from these special causes, the general ones are uterine obliquity, pelvic narrowing, and unusual size of the child. The presentation occurs more frequently in multiparæ than in primiparæ, the proportion being, according to Kleinwächter, 1 of the former to 2.23 of the latter. The presentation may be primary or secondary; the latter is much the more frequent. The duration of labor is in primiparæ 34 hours, and in multiparæ 15 hours. The ordinary fœtal mortality in vertex presentation is 5 per cent., but in face presentation 15 per cent.[1] Premature rupture of the bag of waters, prolapse of the umbilical cord, and tearing of the perineum, are among the accidents liable to occur in face presentations.

Mechanism.—As in presentation of the vertex the occiput was selected as the point of reference, so in presentation of the face the forehead, following the example of Depaul, will be chosen. Most obstetricians select the chin, naming the different positions of the presenting part mento-anterior and mento-posterior, right or left, according to the side of the pelvis in which the chin is placed. But let the student imagine a case of vertex presentation with the occiput at the left ilio-pectineal eminence, and then, while the fœtus is unchanged in its general position, let the head be extended instead of flexed, and it is seen that the forehead at once takes the position which the occiput occupied; and this position is the most frequent in presentation of the face. Further, in many cases at least, presentation of the face is a deviated vertex presentation, and such deviation can be better understood with the nomenclature proposed. The various positions in presentation of the face will therefore be called right or left fronto-anterior and fronto-posterior.

Diagnosis.—Pinard[2] states that examination of the pelvis enables us to recognize the presence of a large tumor at, above, or below the inlet, according to the period of labor at which the examination is made. Moreover, this tumor appears to occupy but one side, and is wanting at the other. Let the hand be now at once placed upon the fundus of the uterus, or both may be first put upon the sides of the uterus (Fig. 125) until the fundus is reached, and then one of them applied to it, and we find, usually upon the side where the pelvic tumor is more prominent, the pelvis which may be recognized by its peculiar characters. In order to follow and appreciate the resisting plane, it is indispensable[3] to depress slowly and deeply the abdominal wall, for this surface seems

[1] Kormann, quoted by Kleinwächter. [2] Abdominal palpation. [3] Pinard, op. cit.

to bury itself in the abdominal cavity, while the superficial parts are readily felt. This is caused by the bending of the fœtus upon its dorsal plane. In operating properly one of the lateral planes can be examined, and it is readily ascertained that the portion of the cephalic

FIG. 125.

PALPATION OF UTERUS, THE HANDS AT ITS SIDES.

sphere most accessible is in relation with the back. Moreover, between the back and the head there is, especially early in the labor, a deep depression into which the fingers sometimes readily enter. According to Budin,[1] one can, in some cases, recognize on the side opposite to the accessible tumor a clearly marked projection having the form of a horseshoe; it is formed by the inferior maxillary and the chin.

Charpentier regards the diagnosis by palpation alone as exceedingly difficult, stating that special conditions must be present, relaxation and thinness of the abdominal walls, and a non-irritable condition of the uterus, in order to thereby make such a diagnosis, but by combining auscultation with palpation the diagnosis can be made. The fœtus occupies a higher position than in vertex presentation, so that the maximum of the intensity of the heart sounds is heard at, instead of below, the transverse line (Fig. 96); further, in consequence of the head being turned toward the back, the latter is removed from contact with the uterine wall, so that the sounds are heard better through the anterior wall of the chest; hence while the back is felt, for example, on the left side of the uterus, the heart-sounds are heard most distinctly

[1] Op. cit.

upon the right side. This want of harmony between the results obtained by palpation and by auscultation leads to the diagnosis of a face presentation, for palpation would point to the conclusion that there was a vertex presentation, but auscultation, both by the fact that the sounds are heard higher up than in such a presentation, and on the opposite side to that upon which the back is found, justifies at least the suspicion that the face presents.

After labor has begun, digital examination brings conclusive proof of the presentation. There will be found upon one side of the pelvis a round, hard part, divided in the median line by the beginning of the sagittal suture, and bounded by the fronto-parietal suture, and in the median line by the bregma; while upon the other side of the pelvis there is felt a smaller, softer, and irregular surface; this surface immediately next to the frontal bone offers two soft, round, small tumors, the globes of the eyes; there is a depressed surface between them, then from it there rises a projecting part which ends in two openings, the nares; below the nares and transverse to them is the mouth, into which the finger may be introduced, and in some cases this introduction is followed by efforts on the part of the infant to suck; below the mouth the chin is found, the direction in which it points being plainly indicated by the opening of the nares.

If the labor has been in progress for some time, the membranes having been ruptured, the face becomes greatly swelled, and its form changed; one feature, however, remains unchanged, the nose; by this the diagnosis of the presentation can usually be made, and when the

FIG. 126.

FRONTO-ANTERIOR POSITION IN PRESENTATION OF FACE.

nose is recognized, the position is known, for the former points in a direction opposite to the forehead. The mouth should not be con-

founded with the anus, for the latter "always presents at its circumference the projection caused by the point of the coccyx."

Left Fronto-Anterior Position.—This is the most frequent position. The back is found by palpation upon the left anterior side of the uterus; the fœtal heart-sounds are heard most distinctly upon the right side. Upon vaginal examination the nose is found pointing toward the right sacro-iliac joint, and hence the forehead must be at the left ilio-pectineal eminence.

1. The first of the mechanical phenomena of labor is increase of extension, the occiput turned against the back; complete extension in presentation of the face corresponds with complete flexion in presentation of the vertex. Its cause is the driving force met by the unequal resistance of the two arms of the face lever. In Fig. 127, *A F* being the long arm, necessarily offers more resistance than *A M*, the short arm; hence the chin descends, and the forehead ascends. Further, the head being already partially extended, prepares the way for

FIG. 127.

ATTITUDE OF THE HEAD IN PRESENTATION OF THE FACE.

complete extension. The result of perfect extension is: There is a lessened area of the head circumference brought in relation with the pelvic area, for, prior to complete extension, that circumference corresponded with a diameter passing from the chin to the bregma, the mento-bregmatic diameter, while now the diameter whose circumfer-

ence occupies the pelvic area is the fronto-mental. There is no loss of force, at least after the waters have been evacuated and direct pressure upon the breech permitted, for the fœtus is no longer "a vacillating rod" in consequence of the mobility at the cervical vertebræ, but compacted together by the occiput being fixed upon the back. Complete extension is recognized by the recession of the forehead, and by the advance of the chin toward the centre of the pelvic cavity.

2. *Descent.*—This does not need to be defined nor its cause explained.

3. *Rotation.*—It is essential, in order that delivery should take place, in the ordinary relations of the size of the pelvis and that of the fœtus, that the chin should rotate anteriorly; that must escape first before any flexion of the fœtal rod is possible. The descent is at an end as soon as the length of the child's neck has been measured upon the pelvic wall, for then the chest tends to enter the pelvis, but the latter cannot accommodate both head and trunk. The length of the pelvic lateral wall is three inches and a half, between nine and ten centimetres, while the anterior wall is only one inch and a half long, four centimetres, a distance readily measured by the neck. Ordinarily, therefore, it follows that rotation of the forehead into the sacral cavity, and of the chin into the pubic arch, occurs before the face reaches the pelvic floor.

FIG. 128.

ROTATION FORWARDS OF THE CHIN.

Dr. Hodge, however, with Velpeau and Chailly, held that in many instances "the chin will pass below the sacro-sciatic ligament, and will often distend the perineum to a great degree." He justified this opinion by the following considerations: first, the length of the neck is to be measured, not from the hyoid bone, but from the chin to the chest.

When the head is in a state of extension we would have at least three inches and a half, and if the neck be elongated, probably four inches from the chin to the sternum. Second, the neck can be elongated to a considerable degree in these cases of great extension.

If these views were correct we would probably have delivery of the fœtus in face presentation without anterior rotation of the chin, as a frequent occurrence. Admitting, too, the great elongation of the neck, claimed by Dr. Hodge, which, however, is of the anterior portion, this does not obviate the difficulty arising from both the head and chest occupying the pelvic cavity at the same time.

The reasons for posterior rotation of the forehead are that it offers a more extensive surface, and the frontal arm of the face-lever is the longer, and hence meets with greater resistance; it finds more room, and can be better accommodated behind than in front. With the corresponding rotation of the chin into the pubic arch the mental end of the face-lever is free, it no longer meets resistance from the bony wall of the pelvis, and the head is no longer pressed against the back, but can be delivered, thus giving room in the pelvic cavity for the descent of the body.

4. *Delivery of the Head by Flexion.*—The chin escapes, and thus the occipito-mental diameter is free to partially rotate. The head is,

FIG. 129.

PASSAGE OF THE HEAD THROUGH THE EXTERNAL PARTS IN FACE PRESENTATION.—The head is becoming flexed and sweeping over the perineum.

as it were, rolled out of the vulvar opening, flexion occurring, the throat applied to the summit of the pubic arch, the chin ascending over the pubic joint until the occipital end of the occipito-mental diameter escapes over the perineum, when the head drops down toward the anus as it did after vertex delivery. Here again we have

illustrated the fact that when one end of the long diameter of the fœtal head enters the pelvis, that end must pass out of the pelvis first.

5. *External Rotation of the Head with Internal Rotation of the Shoulders.*—The conditions are the same as in vertex delivery, and the causes of the rotations and the consequences are identical. The forehead, or the chin, always turns toward that thigh corresponding with the side of the pelvis which it occupied; thus, if the forehead was in relation with the left side of the pelvis it turns toward the left thigh.

6. *Delivery of the Body.*—This is the same as in presentation of the vertex.

Anomalies of Mechanism in Face Presentations.—In some cases there may be in consequence of imperfect extension presentation of the forehead. But this rarely persists, for either flexion occurs and the presentation becomes that of the vertex, or, and this is the more frequent, extension is completed and there is simply a face presentation. Sometimes, however, the forehead remains the presenting part, and is delivered first. The anomalies of the third time, rotation of the chin in front, are the most important. Not only may this rotation fail, but posterior rotation by which the chin turns to the sacral cavity, may occur. Apparently spontaneous expulsion is impossible. Velpeau thought that flexion of the head might then take place by which the vertex would be substituted for the face. But this is impossible after the head enters the pelvic cavity if the fœtus and pelvis are of usual size. Cazeaux suggested that the soft parts might be depressed at the great sciatic foramen, "a depression permitting the chin to escape from the bony canal," so that the long diameter of the fœtal head might turn, and presentation of the vertex be substituted for that of the face. Another explanation was suggested by Dubois from two cases observed by him. The chin was behind and to the right, descent to the inferior strait occurred, and after the chin passed below the great sciatic ligament it depressed the soft parts so that space was gained to permit flexion of the head at the expense of the elasticity of the pelvic floor, and labor ended with presentation of the vertex.

Pajot remarks that in directly posterior positions, which are so rare, that he has never seen one, that Chailly has suggested an analogous mechanism theoretically probable, permitting spontaneous delivery. The chin having reached the point of the coccyx, depresses the pelvic floor so that rotation of the occipito-mental diameter can occur, and the occiput is disengaged under the pubic arch. But whatever opinion may be suggested as to the termination of the labor in mento-posterior positions,[1] practice demonstrates that they very rarely persist, and, moreover, when rotation of the chin does not occur, difficulties ordinarily arise requiring the intervention of art.

Plastic Changes.—The form of the head is dolicocephalic; the longitudinal diameters are increased, the vertical and transverse diminished.

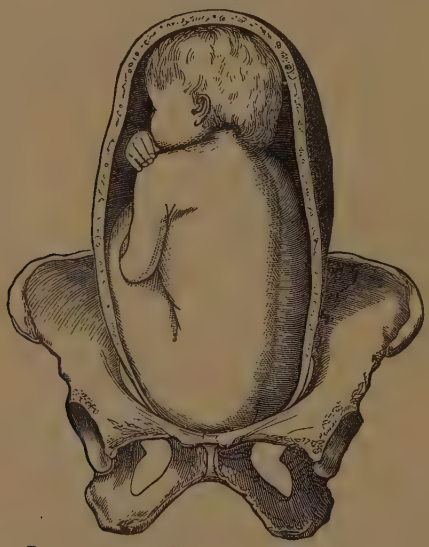
The face is greatly swelled and discolored; the eyelids likewise, and it is impossible for the infant to open them; in some cases the lips are so greatly swollen that the infant cannot nurse; very often subconjunctival hemorrhage is present.[2] The caput succedaneum occu-

[1] Pajot. [2] Tarnier.

pies the inferior part of the malar region and the side of the mouth in fronto-posterior positions; on the contrary it is situated upon the superior part of the malar region and even upon the eye in fronto-anterior positions. Mauriceau[1] has given a very graphic description of the appearance of a child's face after birth with facial presentation.

Right fronto-posterior position is the reverse of left fronto-anterior; and just as the former might be considered a deviation of the most frequent position of vertex presentation, extension taking the place of flexion so that instead of the occiput the forehead is at the left ilio-pectineal eminence, so, imagining first the next most frequent position of vertex presentation, right occipito-posterior, we may suppose a deviation to result from extension taking the place of flexion so that the forehead instead of the occiput is placed at the right sacro-iliac joint. The mechanism of labor is the same as has been described. 1. Completion of extension. 2. Descent. 3. Rotation. As the chin is so much nearer the pubic arch in this position than in left fronto-anterior, this process occupies much less time. 4. Delivery of the

FIG. 130.



PELVIC PRESENTATION. RIGHT SACRO-ANTERIOR POSITION.

head by flexion. 5. External rotation of the head with internal rotation of the shoulders. 6. Expulsion of the body. It is not necessary

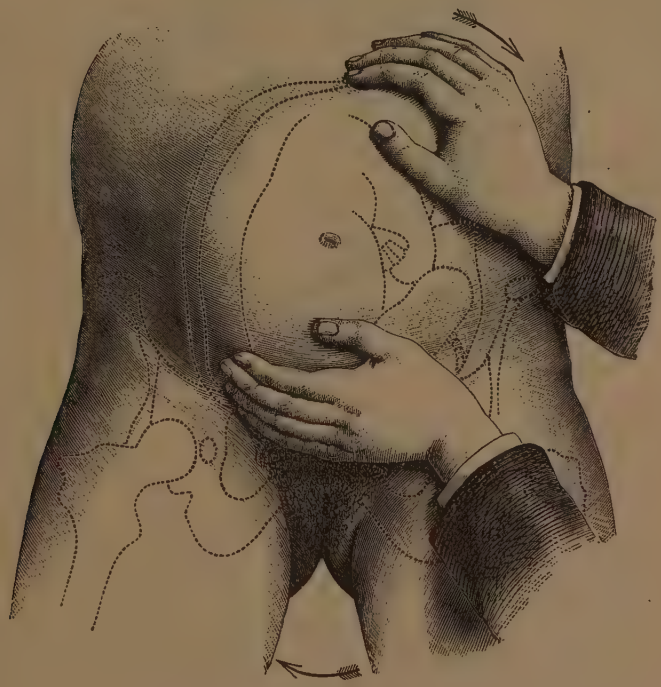
[1] In Mauriceau's Diseases of Women with Child, etc., translated by Hugh Chamberlen, and published in 1727, the great French obstetrician tells of a child being born face first, that "came with the face so black and misshapen as soon as it was born, as usually in such cases, that it looked like a blackamoor. As soon as the mother saw it she told me that she always feared her child would be so monstrous, because when she was young with child she fixed her looks very much upon a blackamoor belonging to the Duke of Guise, who always kept several of them. Wherefore she wished that, or at least cared not though it died, rather than to behold a child so disfigured, as it then appeared. But she soon changed her mind when I satisfied her that this blackness was only because it came faceling, and that assuredly in three or four days it would wear away."

to more than mention the names of the two other positions of face presentation, right fronto-anterior and left fronto-posterior, for a description of the mechanism of labor in these positions would be essentially a repetition, and is therefore unnecessary.

Pelvic Presentations.—Presentations of the pelvis are next in frequency to those of the vertex, and occur once in twenty to thirty cases in single pregnancies, but more frequently in twin pregnancies. Excluding cases of premature labor, pelvic presentations occur, according to Pinard, one in sixty-two.

Varieties and Causes.—Usually the upper and lower limbs occupy the same position with reference to the trunk that they do in vertex or in face presentations. In some cases, however, not only are the thighs flexed upon the abdomen, but the legs extended over the chest, the fœtus being thus as it were doubled. The knees may descend first, though, according to Spiegelberg, such presentation is never primitive, or one or both feet may descend, but these various modifications do not affect the essential mechanism of labor. Whether knees, feet, thighs, or pelvis present, all are included under the general name of pelvic pre-

FIG. 131.



DIAGNOSIS OF PELVIC PRESENTATION BY PALPATION.

sentations. Multiparity, premature labor, hydramnios, multiple pregnancy, the fœtus being dead, or of small size, or hydrocephalic, pelvic narrowing, uterine tumors, and placenta prævia are the chief causes of pelvic presentations. In regard to the last, it is probable that it is not

the fact of the placenta being prævia which causes pelvic presentation, but they both result from a common cause, the condition of the uterus.

Diagnosis.—Before labor the pelvic cavity will be found empty, and the lower portion of the fœtal ovoid is partly in one or the other iliac fossa usually, and partly over the inlet; there will be found adjacent to this portion, except when the legs are extended over the chest, small movable parts; the head is in the upper portion of the uterus, and in the majority of cases at the right side, though in the illustration it is represented in the left, and cephalic ballottement may be made. Upon auscultation the maximum of intensity of the heart sounds will be found above the horizontal line at Fig. 96.

FIG 132

PELVIC PRESENTATION.—*A*, Place where sounds of fœtal heart are heard most distinctly in left sacro-anterior position.

Early in the labor before the presenting part has descended into the pelvic cavity, and the fœtal sac is entire, it will be difficult or impossible to make a diagnosis by vaginal examination. The bag of waters is large, and is sometimes described as "pudding-shaped;" such size and shape, and difficulty in reaching the presenting part render it probable the presentation is pelvic. After the rupture of the sac and the descent of the pelvis, there usually is no difficulty in making a diagnosis. The finger touches a round object, but it is softer, less uniform in shape than the head, and has neither sutures nor fontanelles, nor the feeling of the scalp, wrinkled and covered with hair. The separation between the

buttocks, the coccyx, the sacral crest, the anus, and the sexual organs may be recognized; if the child be alive the anus contracting resists the effort to introduce the finger, and the latter upon withdrawal will be covered with meconium. If the feet are pressed against the thighs, so that one of them may be touched by the finger, the diagnosis becomes easier. If the coccyx be felt the position is at once known, for the point of the coccyx is always directed toward the anterior plane of the fœtus. If a foot only is accessible to touch, it is distinguished from the hand by being at a right angle to the leg, by its being thicker upon one side than upon the other, by the toes being placed in the same line, by the impossibility of separating the great toe from the second, and bringing the former in apposition to the other toes, or the thumb can be separated from the index finger, and brought in apposition to the fingers; the projection of the os calcis is also an important mark by which the foot can be distinguished from the hand. Presentation of a knee is very rare. The knee is broader than the elbow, and the patella flat while the olecranon is pointed; the thigh and the leg, between which the knee is felt, are thicker than the arm and the forearm. If there still be uncertainty in the diagnosis, the member may be extended, and then the foot will be recognized. When the leg is extended the toes point to the anterior plane of the fœtus; but if the leg be flexed upon the extended thigh the toes point to the posterior plane. The fœtal mortality in pelvic presentation is, according to Dubois, 1 in 11, according to Churchill, 1 in $3\frac{1}{7}$.

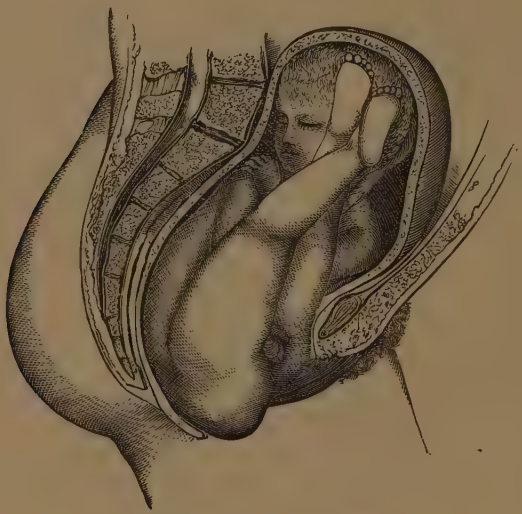
Mechanism of Labor.—The positions are named according as the sacrum of the fœtus is anterior or posterior, in the left or right side of the mother's pelvis; thus we have four positions for pelvic presentations: 1, left sacro-anterior, the sacrum being at the left ileo-pectineal eminence, the most frequent position; 2, right sacro-posterior, the sacrum being at the right sacro-iliac joint; 3, right sacro-anterior; and 4, right sacro-posterior. Here, too, there are six stages, times, or processes in the mechanism of labor, as have been given in presentation of the vertex, and in presentation of the face.

1. *Compression of the Presenting Part.*—Just as a scattered crowd is brought into a compact mass in order to go from a ferry-boat to the landing wharf, so the presenting part is compacted together, reduced to the smallest dimensions in order that it can be transmitted through the birth-canal. It is a process of lessening, of adaptation of the passenger to the passage. In presentation of the vertex this process was by completion of flexion, and in presentation of the face by completion of extension; in all the changes there is a lessening of the presenting part, and the means by which the changes are effected are the same driving and resisting forces, and in all the purpose of the change is the same, the fœtal region is given a volume corresponding with the canal through which it must pass.

2. *Descent.*—This needs no explanation. 3. Rotation of the anterior hip into the pubic arch, so that the bistrochanteric diameter is placed in relation with the antero-posterior diameter of the outlet; this rotation includes the trunk of the child. 4. Delivery of the

body: The anterior hip is at the pubic arch, and the posterior at the other end of the coccypubic diameter.

Fig. 133.



Expulsion of the Breech.

The pubic thigh remains fixed, forced against the subpubic ligament, and makes the pivotal point upon which, by partial curvature, the hips pass out; the posterior thigh sweeps along the perineal gutter, and the lower portion of the body is delivered, greatly ante-flexed. The anterior shoulder now descends into the pubic arch, is fixed there, while the posterior shoulder sweeps over the perineum and is delivered first, meantime the arms and forearms remaining closely applied to the chest.

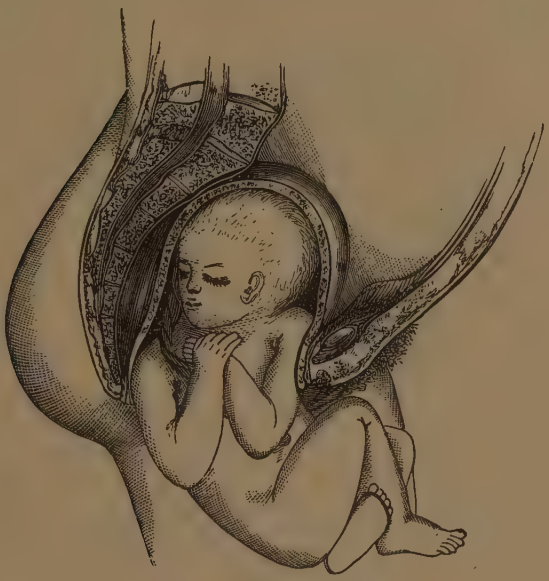
5. *Internal Rotation of the Head and External Rotation of the Trunk.*—This movement is designed to bring the occiput behind the pubic joint, and the face in the sacral cavity. It is essentially the same as that which is observed in a vertex presentation, only it occurs last instead of first. Its purpose is to place the head in the most favorable position for expulsion, a sub-occipital being brought in relation with the longest diameter of the outlet.

6. *Delivery of the Head.*—The head is forced down, the chin closely applied to the chest, the nucha pivots against the pubic arch, while the chin is born first, then the face, forehead, bregma, and, finally, the occiput emerge, the diameters presented being, as in head-first deliveries, sub-occipital.

Anomalies in the Mechanism.—The only one of importance is that which may occur in the fifth time, arising from the failure of the occiput to rotate behind the pubic joint, but which rotates into the sacral cavity; the back of the child, instead of being anterior, is now posterior. The mechanism is different according as flexion of the head

remains, or as extension occurs, the chin pressed against the chest in the one case, but departing from it in the other. In the former the

FIG. 134.



EXPULSION OF THE SHOULDERS.

nucha presses upon the anterior margin of the perineum, and the head is delivered by extension occurring, the face, forehead, bregma, and occiput passing out in succession, the back of the child being turned toward the mother's back. But when the chin departs from the chest it is delayed above the pubic joint, extension is completed so that the occipital end of the occipito-mental diameter passes out first, then the rest of the head, delivery occurring by flexion, the throat pivoting upon the pubic arch; the abdomen of the child in the delivery comes toward the abdomen of the mother.

Plastic Changes.—The caput succedaneum is usually found upon the anterior thigh, but the swelling may also involve the external genitals, which may be greatly discolored. The head is remarkable for its round appearance; this arises from the fact that it is pressed at all points except at the top.

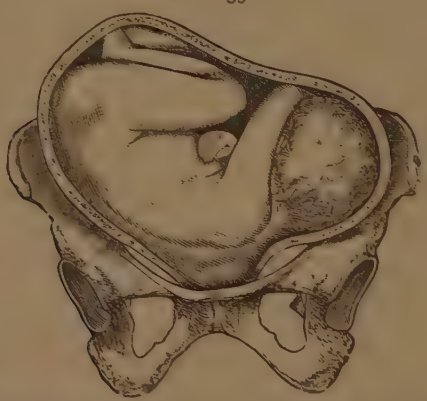
Mechanism in the Different Positions.—First. Left sacro-anterior: 1. Compression. 2. Descent. 3. Rotation. It is unnecessary to give all the details. In this position the back is toward the mother's left side anteriorly, the sacrum at the left ilio-pectineal eminence, the bis-trochanteric diameter is in relation with the left oblique, and the sacro-pubic with the right oblique of the inlet. The anterior hip, here the left, rotates from the right into the pubic arch. 4. Delivery of the body: The left hip is fixed at the pubic arch, pressing against the

sub-pubic ligament; the right hip passing over the sacro-coccygeal concavity and the perineal floor, emerges at the anterior perineal margin, the body of the fœtus being curved upon its left lateral plane. The shoulders descend—the bisacromial diameter has the same relation with the coccypubic diameter that the bis-trochanteric had—and the trunk is entirely born.

5. *Internal Rotation of the Head and External Rotation of the Body.*—The occiput turns from left to right behind the pubic joint, the chin firmly pressed upon the chest. 6. Delivery of the Head: This occurs by extension, the chin passing out first, then the rest of the face, the forehead, the bregma, and the occiput—the back of the fœtus is directed toward the abdomen of the mother. 2. Right Sacro-Posterior Position: In this position the sacrum is directed to the right sacro-iliac joint. The right hip is anterior. The only difference in the mechanism from that observed in left sacro-anterior position is that the right hip turns from the right side in front. The mechanism in each of the other positions can be readily understood from the descriptions that have been given.

Presentation of the Shoulder.—Either the right or the left shoulder may present, and for each there are two positions, depending upon the relation of the back of the fœtus to the abdomen of the mother, and hence known as dorso-anterior and dorso-posterior. Presentations of the right shoulder are somewhat more frequent than those of the left; dorso-anterior positions are at least twice as frequent as dorso-posterior. Pinard indeed states that he never met, during pregnancy, with shoulder presentations unless occupying a dorso-anterior position. Shoulder presentations occur once in about 125 labors, Pinard; 6 to 7 in 1000, Kleinwächter; 1 in 297 Galabin gives as the proportion found from the statistics of Guy's Hospital Lying-in Charity.

FIG. 135.



TRANSVERSE PRESENTATION. DORSO-ANTERIOR. PRESENTATION OF RIGHT SHOULDER.

Causes of Presentation of Shoulder.—Smallness of the fœtus, its being dead, premature labor, hydramnios, peculiar shape of the womb, plural pregnancy, relaxation of uterine and of abdominal walls, pelvic narrowing, and placenta prævia are given as causes. As to the last,

the remark made in regard to pelvic presentations being similarly caused, is here also applicable.

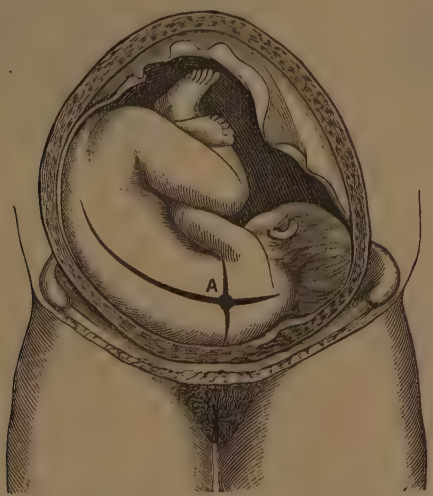
Diagnosis.—1. Before labor begins, according to Depaul, the maximum of intensity of the fœtal heart-sounds is at the level of the line

FIG. 136.

TRANSVERSE POSITION. DORSO-POSTERIOR. PRESENTATION OF RIGHT SHOULDER.

dividing the uterus in two equal parts, and the line of decrease of this maximum is horizontal, not vertical. This is shown in the illustration, Fig. 137.

FIG. 137.

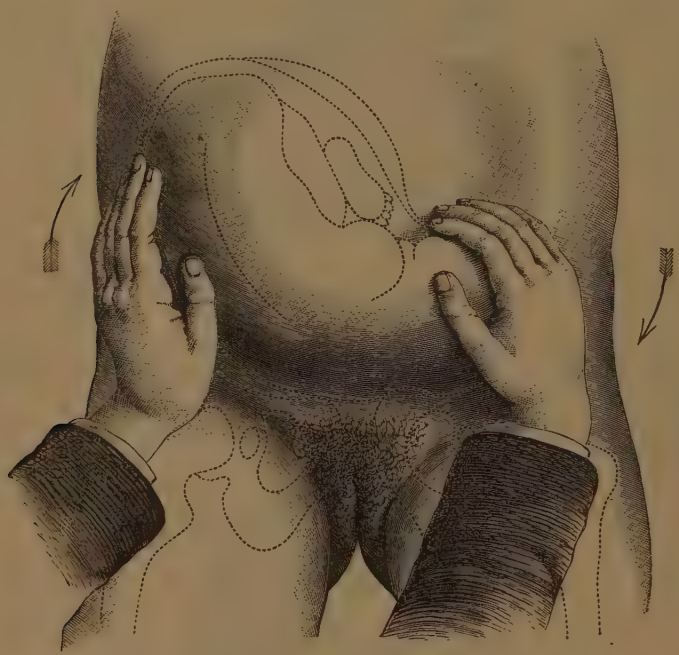


A. POINT OF MAXIMUM OF INTENSITY OF SOUNDS OF FŒTAL HEART IN PRESENTATION OF THE SHOULDER.

By abdominal palpation the form of the uterus is found very different from the usual shape, being increased transversely; but it is a mistake to suppose, as is represented in some drawings, that the fœtus will be

found lying with its head in one, its hips in the other iliac fossa, for apart from any other reason, the distance between the fossæ is much less than the length of the fœtal ovoid at or near term. The head is usually lower than the hips, for the shoulder, in most cases, is in relation with the pelvic area. Then by palpation the head is felt in one iliac fossa while the breech is found in the opposite flank, and a resisting plane connects the two; cephalic ballottement is possible (Fig. 138). Vaginal examination is without value prior to labor.

FIG. 138.



SHOWING DIAGNOSIS OF SHOULDER PRESENTATION BY PALPATION.

During labor auscultation remains the same. The head is pressed nearer the inlet, and can be felt more distinctly, but ballottement is now impossible. The pelvic extremity is brought nearer the fundus of the uterus, toward the median line, and the resisting plane which unites the two ends of the fœtal ovoid is also brought nearer the vertical line.[1]

Depaul has dwelt upon the "peculiar physiognomy" of labor in case of shoulder presentation. The uterus does not contract with the same regularity that it does in vertex presentation; very frequently quite a long time passes in which the contractions come, are suspended, and then resume, without producing a marked effect; the os scarcely dilates, and sometimes twelve, twenty-four, forty-eight hours, or even more pass, without the part engaging in the inlet. The bag of waters

[1] Charpentier.

is unusually large, and sometimes reaches down between the labia. If the presenting part cannot be reached by the two fingers, and auscultation and abdominal palpation have rendered it probable that the shoulder presents, it is better to introduce the hand into the vagina so that the diagnosis may be made certain. The shoulder is round, and presents a bony prominence, the acromion; but the most characteristic feature is the axilla, with the ribs parallel to each other, like the bars of a gridiron, called by Pajot the intercostal gridiron. The cavity of the axilla formed by the arm and the wall of the chest represent an angle opening towards the hips, and its apex pointing towards the head; and hence when this is recognized the side occupied by the head is at once known. Next, the position of the breech is to be determined, whether anterior or posterior; this is done by feeling the scapula or the clavicle, the former corresponding to the posterior, the latter to the anterior plane of the fœtus; in some cases the spinous processes of the vertebræ may be readily felt.

If the elbow presents, it is recognized by being smaller than the knee, and the olecranon pointed while the patella is flat; if there be doubt, the forearm should be extended, and the hand will be readily recognized. The elbow, before the forearm is extended, points from the head. Should the hand descend, the means of distinguishing it from the foot mentioned in the diagnosis of pelvic presentation are to be used; there is usually no difficulty in making this diagnosis. But it does not necessarily follow that there is a shoulder presentation because the hand descends, for this may happen in presentation of the head, or of the breech, and therefore it is necessary by auscultation, by palpation, and by vaginal touch, to know that the prolapsed hand is not a complication of either of these presentations. Supposing the hand to descend in a shoulder presentation, it is important to know whether it is the right or left hand. Two very simple ways are presented; by following either, the question is answered. Put yourself in its place, and shake hands. That is, let the obstetrician imagine one of his own hands occupying the same position, and he at once knows which hand. Or let him apply one of his own hands to the projecting hand, the right, for example; if palm corresponds with palm, and the thumbs are directly applied to each other, it is the right hand.

The hand[1] gives the shoulder; the back of the hand the situation of the head; the direction of the thumb indicates the direction of the breech; when the breech is posterior, the thumb is directed above from the side of the pubic joint; if the breech is anterior, the thumb is directed below, towards the anus.

Three modes of spontaneous delivery may occur in shoulder presentation:—

1. As observed by Roederer, Kleinwächter, and others, the fœtus may be delivered doubled; but this is only possible when it is small, very flexible, and compressible.

2. Spontaneous version by which the head or breech is substituted

[1] Charpentier.

for the shoulder may occur; if the head take the place of the shoulder, the change is known as cephalic version, but if the breech, pelvic version. Spontaneous version has been attributed to the active movements of the fœtus, and to irregular uterine contractions. It would seem more natural to explain the change as resulting from the uterus taking, though tardily, its normal ovoidal form, and compelling the fœtal ovoid to occupy its corresponding position.

3. Spontaneous evolution is the term given to the delivery, when, the shoulder still presenting, a series of changes, or mechanical phenomena essentially the same as those that have been described in connection with delivery in other presentations take place. These are:—

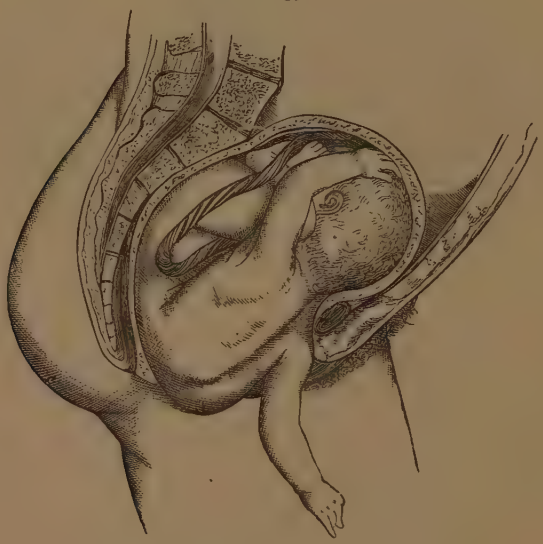
1. Compression by which the presenting part is lessened, and thus adapted to the canal through which it must pass.

2. Descent. This stage requires no description.

3. Rotation of the shoulder into the pubic arch. These three stages occupy considerable time, during which the fœtus in most cases dies. The shoulder is the smallest part of the fœtal wedge, and hence advances first, driven in the direction of least resistance. With the rotation of the shoulder the head moves anteriorly and is fixed above the pubic joint.

4. Delivery of the body. The anterior shoulder remaining fixed at the sub-pubic ligament, the posterior shoulder is forced down the

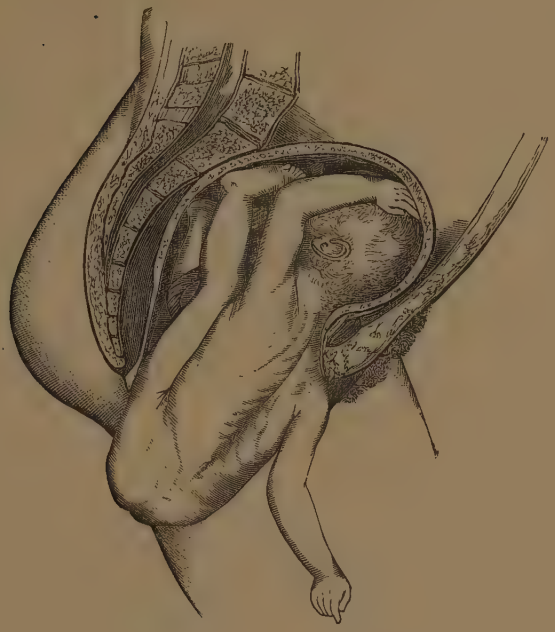
FIG. 139.



SPONTANEOUS EXPULSION.—First Stage.

sacro-perineal curve, the body being strongly latero-flexed. By referring to Figs. 139 and 140, it is seen that the right shoulder is anterior, and remains fixed, while the left or posterior shoulder is driven further down; this shoulder finally passes out at the anterior

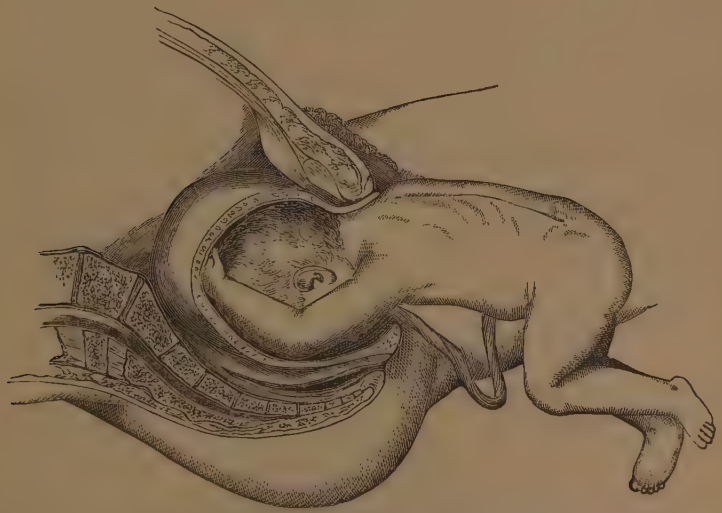
FIG. 140.



SPONTANEOUS EXPULSION.—Second Stage.

margin of the perineum and is followed by the chest, abdomen, and hips, and then the anterior shoulder is delivered, the head only remaining in the pelvis.

FIG. 141.



SPONTANEOUS EXPULSION.—Third Stage.

5. Internal rotation of the head and external rotation of the body. This is the same as that which occurs in pelvic deliveries.

6. Delivery of the head. This, too, is the same as in pelvic delivery.

Caput Succedaneum.—This is situated upon the shoulder which has presented; when the arm prolapses, it also is swelled and discolored, and frequently is the seat of phlyctenulæ.

Of course, shoulder presentations are not trusted to spontaneous delivery, but demand the intervention of art. Nevertheless, it was important to present nature's method of dealing with these abnormal presentations. The student will recognize the truth of the statement made at the beginning of this exposition of the mechanical phenomena of labor, that there is a unity in this mechanism, one general plan, one common end. That this may be made, if possible, still clearer, the following table, including the different presentations, with the associated mechanical phenomena of labor, is given:—

Vertex Presentation.	Face Presentation.	Pelvic Presentation.	Shoulder Presentation.
1. Flexion of the head.	Extension of the head.	Compression of pelvis.	Compression of shoulder.
2. Descent.	Descent.	Descent.	Descent.
3. Rotation of head.	Rotation of head.	Rotation of pelvis.	Rotation of shoulder.
4. Delivery of head.	Delivery of head.	Delivery of body.	Delivery of body.
5. Internal rotation of body.	Internal rotation of body.	Internal rotation of head.	Internal rotation of head.
6. Expulsion of body.	Expulsion of body.	Expulsion of head.	Expulsion of head.

CHAPTER III.

THE CONDUCT OF LABOR.

HAVING considered the phenomena of labor, its conduct or management is now to be presented. Giving birth to a child, though a physiological function, differs very materially from any other function of the organism. These differences are duration, suffering, and traumatism. Intelligent art may in many instances shorten the first, and lessen the second and third. Even admitting that the savage woman[1] may safely bring forth alone, or with only an ignorant attendant, the civilized woman is in many instances very far from being in a physiological condition, and thus childbirth brings to her peculiar pains and perils; her higher development renders her more susceptible to bodily suffering, and in many instances has been attained by the partial sacrifice of physical endurance and vital force. Moreover, in cases of labor for a time advancing favorably, sudden accidents imperilling the life of mother or of child may arise, and professional knowledge and skill be needed to meet them; while the common role of the obstetrician is "to observe, to control, to alleviate, and to protect," emergencies may come which demand his promptest action and greatest ability. It is, therefore, important, in her own interest and in that of her offspring, that woman should have in labor a qualified professional attendant.

Two important questions, the one relating to antisepsis, the other to anæsthesia, may be considered at the beginning of this exposition of the obstetrician's duties.

Antisepsis.—With our present knowledge of the gravest diseases which affect the lying-in woman, it is very probable they are caused by microscopic germs; hence it is important that woman in labor should as far as possible be protected from the presence of such germs, and their entrance into her organism be prevented; in a word, that the process of childbirth shall be aseptic. As part of the means for the attainment of this end, it is important that the lying-in room be well ventilated and free from disease germs, or from the poisonous influence of sewer gas. I have seen in consultation a case of puerperal septicæmia in a multipara, who occupied a room in which three months before two of her children were ill with diphtheria; in another patient the lying-in room had a wash-stand communicating with a badly-

[1] The following statement is made by Dr. Engelmann in his very interesting volume, Labor among Primitive Peoples, p. 7: "Among primitive people, still natural in their habits and living under conditions which favor the healthy development of their physical organization, labor may be characterized as short and easy, accompanied by few accidents and followed by little or no prostration."

drained sewer; in a third the disease apparently had its origin in the poison of scarlet fever, the husband, a physician, attending some malignant cases of the disease immediately before and after his wife's confinement, and spending most of his time in her room.

Thorough disinfection of the room which the patient is to occupy should be made, if it has been previously occupied by one suffering with scarlet fever, with erysipelas, or diphtheria, or with any disease attended with suppuration, as uterine cancer in its advanced stages; it would be better, indeed, for her lying-in to be in another house or other room. The room, too, should be free from the effluvia of decaying animal matter. If there be any sewer communication in it, as, for example, from a permanent wash-stand, that communication should be, for the time at least, cut off. The obstetrician must know that the nurse has not recently been in attendance upon any of the forms of disease that have been mentioned, and especially upon a case of puerperal septicæmia.

It is well for the parturient to take a warm bath at the beginning of her labor, and afterward to have the external genital organs washed with a two to three per cent. solution of carbolic acid; when the labor is protracted, a similar solution may be used as a vaginal injection once or oftener. A three to five per cent. solution may be used by the physician, and by the nurse for washing their hands. The former, not only should use an antiseptic solution in which he washes his hands before each examination, but also an antiseptic ointment applied to the finger or fingers before introduction into the vagina; this may be carbolized cosmoline, or iodoform and cosmoline, the unpleasant odor of the iodoform being removed by the addition of a few drops of oil of bitter almonds, or an ointment may be made by incorporating with one ounce of vaseline, or of cosmoline, one-tenth part of thymol. All metallic instruments that may be used should be first disinfected by being put in hot water, and afterward in a five per cent. solution of carbolic acid. No soiled clothes, or vessels containing evacuations from the patient's bladder or bowels should be allowed to remain in the room.

In regard to disinfection of the obstetrician's hands, Tarnier states whenever he thinks his own need this he washes them in Van Swieten's solution.

Some accoucheurs have gone so far as to have women delivered under antiseptic spray, but this is hardly necessary in hospital, still less in private practice. As Spiegelberg has said, all that is necessary can be attained if the utmost cleanliness is observed, and if the genitals are disinfected.

At the Hôpital de la Charité, Paris, Bernutz[1] uses the following disinfectant solution:—

Essence of gaultheria	One part.
Water	Ten parts.
Rectified alcohol	Twenty parts.

The hands of the accoucheur are first thoroughly washed with soap and water, a brush being used, then bathed in this solution. After delivery,

[1] Archives de Tocologie, February, 1883.

the patient's toilette is made with one part of the solution, and three of warm water.

This preparation has the advantage over carbolized water in being of a pleasant odor, while the latter is pungent and disagreeable; Spiegelberg, however, regarded the strong odor of carbolic acid as advantageous, for this proved its presence, and also showed that to some extent it disinfected the surrounding atmosphere.

The use of antiseptics after labor will be considered in connection with the management of the puerperal state.

Anæsthesia.—Early in 1847 the illustrious Sir James Y. Simpson proved that inhalation of sulphuric ether could be safely and successfully used for the relief of pain in childbirth, and later in the year he established the same fact as to the inhalation of chloroform. Obstetric anæsthesia soon found a few in Great Britain and on the continent to advocate and practise it. In the United States, Dr. N. C. Keep, of Boston, was the first American physician to administer an anæsthetic in labor. But Dr. Walter Channing was the most distinguished of American physicians advocating the practice; his treatise on Etherization in Childbirth was published in 1848. The late Professor Henry Miller, of the University of Louisville, gave chloroform to a woman in labor, on the 13th of March, 1848; this was the first time chloroform was thus used west of the Allegheny Mountains. Dr. Miller remained faithful to anæsthesia in labor the rest of his honored life; he strongly advocated the practice, and with his well-known ability answered the arguments adduced against it. Channing and Miller are the two names that in this country shine with the most lustre in connection with the early advocacy of obstetric anæsthesia.

On the other hand, three of the most eminent obstetric teachers, Meigs, Hodge, and Bedford, strongly opposed the use of anæsthetics in normal labor, and their influence was more powerful than that of its advocates. The controversy here was but the reflex of that which was occurring in Great Britain. Simpson asserted that it was only a question of time as to the general adoption of anæsthesia in parturition. On the other hand, Dr. Ashwell, who, with Tyler Smith and Ramsbotham were the most prominent London obstetricians opposing the practice, declared that "unnecessary interference with the providentially arranged process of healthy labor is sure, sooner or later, to be followed by injurious or fatal results," "that chloroform need only be extensively used to insure its entire abandonment," and that it was "a duty to urge every plea against its further use." More than thirty-five years have passed since these words of Simpson and of Ashwell were uttered; the prophets are dead, but the prophecy of neither has been fulfilled; chloroform has not been generally adopted, nor has it been entirely abandoned in obstetric practice.

Doubtless the influence of Doctors Meigs, Hodge,[1] and Bedford did much in this country to prevent the use of anæsthetics in labor. It is

[1] And yet Dr. Hodge, while refusing the parturient the relief to be had from chloroform, indicates the severity of her suffering by saying that she is "agonized and semi-delirious."

certain that the great majority[1] of women in the United States endure the martyrdom of maternity without anæsthesia. On the other hand, it often happens that a brief surgical operation, in many instances much less painful than childbirth, is not done until the subject is anæsthetized.

Various objections have been made to anæsthetics in physiological labor. It is needless to mention the argument drawn from the Bible, which was so triumphantly answered by Sir James Simpson, nor the assertion that suffering in labor is necessary in order that the mother shall love her child—nature seems to have made no corresponding provision to secure paternal love. Another objection, which also once had its day, was that an anæsthetic caused lascivious dreams. Coming to more recent, and apparently more reasonable objections, we may consider those which have been ably presented by Depaul[2] in summing up his arguments against obstetric anæsthesia: "1, it may kill the patient; 2, the anæsthetic sleep deprives her of reason so that she cannot participate in the great act accomplished, and this participation is in almost all cases necessary; 3, the inconveniences and dangers are not compensated by the advantage arising from the diminution or suppression of pain."

In reply to these objections it may first be answered, as Dutertre[3] has said, that there has not been a single case of death that can be certainly attributed to obstetric anæsthesia, notwithstanding the immense number of accouchements in which it has been employed. "Chloroform has been used in natural labor many hundreds of thousands of times, yet but a single case of death is on record where it was administered by a competent medical man, and in this there is a lack of post-mortem confirmation. Three other cases have been given at second hand and without particulars."[4] Many causes contribute to the almost complete exemption from danger. These are the position of the patient being horizontal, the intermittence in the use of the anæsthetic, the gradual manner of administration, the anæsthesia not being profound, the influence of uterine contractions, the uterus alternately relaxing and contracting reinforces the action of the lungs and heart, and thus asphyxia and syncope are avoided, and finally, as urged by Dr. Campbell, of Paris, the anæsthetic causes cerebral anæmia, while labor-pains produce an opposite effect.

In answer to Depaul's second objection, it may be stated that it is not such a degree of anæsthesia that the patient is unconscious and incapable of voluntary effort, not surgical but obstetric anæsthesia which is sought. If the first and second objections are satisfactorily answered, the third is without force. That the labor is rendered slower when the anæsthetic is properly given, or the patient is more liable to

[1] For example, in the Summary of Obstetric Cases reported by members of the East District Medical Society, and compiled by Dr. Samuel W. Abbott, Boston Medical and Surgical Journal, July 6, 1882, in only twelve per cent. were anæsthetics used: as showing the great preference by New England physicians for ether, it was used in 323, and chloroform in only 2 cases.

[2] Dictionnaire Encyclopédique des Sciences Médicales. [3] Op. cit.

[4] Handbook of the Medical Sciences, vol. i. Dr. J. C. Reeve.

post-partum hemorrhage are as yet unproved assertions. In regard to the first, moderate anæsthesia does not lessen the force of either uterine or abdominal contractions, unless there be some idiosyncrasy, or if it does it brings a compensation by diminishing the resistance which those contractions must overcome. Admitting that the labor may be rendered slower in some cases, the lessened suffering makes the trial not so severe and exhausting. Admitting, too, that there may be a liability to post-partum hemorrhage, a proper management of the third stage of labor, and the timely use of ergot are almost certain to avert the danger. In further considering the subject of the relief of pain in labor, it will be convenient to divide it into general and local anæsthesia.

1. *General Anæsthesia.*—This is usually accomplished by inhalation of an anæsthetic vapor. Chloroform[1] is preferred by most to ether because of its pleasanter odor, its prompter action, and the less quantity required. On the other hand, ether is the safer; its administration is much less liable to cause profound narcosis; by some it is held that relaxation of the uterus and post-partum hemorrhage are much rarer after its use than after that of chloroform.

If chloroform be employed, it may be inhaled from a handkerchief or small napkin, upon which half a teaspoonful is poured at a time; the napkin or handkerchief is held close to, but not touching, the patient's nose. For the administration of ether an extemporaneous inhaler may be made by first making a cone of a stiff towel, then this cone is surrounded at the sides and covered upon the top by thick, firm paper; a sponge as large as the fist is pressed into the cavity of the cone, and saturated with ether, being careful that the quantity is not so great as to drip upon the patient's face when the instrument is used. The hollow base of the cone is now placed so as to closely encircle the patient's mouth and nose. The anæsthetic is not to be used except just before and during a "pain," the purpose being not to cause unconsciousness, but to lessen or remove suffering while intelligence and will remain in full exercise.

Anæsthetic inhalation is more frequently used in the second than in the first stage of labor. It may, however, be especially needed in the latter; for example, in the case of a primipara where "pains" are unusually severe, and the os dilates very slowly, the new experience wearies, weakens, and disheartens her, and great nervous irritability ensues; but now blunt the sharp edge of her suffering by an anæsthetic, and a happy change will often result in her mental and physical condition. In general, the indication for anæsthesia is great suffering, no matter whether this occur in the first or in the second stage of labor. Dr. J. C. Reeve, of Dayton, Ohio, whose name is so well known in connection with the subject of anæsthesia, states[2] that "the periods of labor to which it is best adapted are two: when distension is greatest of the os, and of the vulva. The kind of labor where it does best is that in which energy of contractions is great, and expulsive force is in excess of dilatation."

[1] Dr. Fordyce Barker informs me that he always uses chloroform, and that he uses it in all cases of labor.

[2] Private communication.

In all cases the practitioner will be guided by the effect of the anæsthetic, withholding, lessening, or increasing, as may be indicated; he will never carry the anæsthesia so far as to suspend consciousness, unless during the birth of the head, and after it is born the use of the anæsthetic should stop.

The bromide of ethyl has been especially advocated as the best anæsthetic in labor by Lebert[1] and by Montgomery.[2] The former has said: "I always employ the bromide of ethyl in both normal and abnormal accouchements; advanced diseases of the heart and chronic affections of the lungs are in my opinion the sole contraindications: 1, because it lessens or suppresses the pain of childbirth; 2, because it has no injurious effect upon the health of the mother or of the child; 3, because the delivery of the child as well as of the placenta takes place more rapidly, and manual intervention is less frequently necessary; 4, because no injurious modification of the puerperal state results, but shorter convalescence, no hemorrhages, no complications, and return to health occurs in a brief time. I am certain that no woman using this anæsthetic in labor would wish to be delivered again without it."

Montgomery used it in twenty-nine cases, and was so well pleased with its action as to regard it as a necessity in the practice of obstetrics. "The ethyl was administered with the advent of each pain, by holding over the face of the patient a napkin upon which a few drops had been poured. This was removed as soon as the pain had subsided. There was no choking or suffocation, as in chloroform, and entire absence of the stage of excitement. After one inhalation, the patient invariably begged for it with each recurring pain. With small quantities the sensation of pain was blunted, while intelligence was uninterrupted; the patient was perfectly subject to control and ready to render or withhold voluntary efforts as desired. Under such treatment, the expulsive efforts resembled those made to evacuate obstinately constipated bowels, and were not attended with more pain. In multiparæ the usual expression was that they had never known such relief. No diminished power in the uterine contractions was observed subsequent to its use; in fact in many of the cases where before the contractions had been ineffective and irregular, they became stronger and regular."

While Montgomery regards bromide of ethyl as apparently entirely safe, given as he uses it, Wood's[3] statement is that it appears to be more dangerous than chloroform, and will probably never be used to any extent in practical medicine.

Cohn,[4] in an address before the Berlin Gynecological Society, has given the results of his experience with different anæsthetics in labor.

Nitrous Oxide Oxygen.—This is a mixture of nitrous oxide gas and pure oxygen, the latter being in such quantity as to render the mixture innocuous; in fact, it can be inhaled for hours together without any bad results. In most cases its results were entirely satisfactory, but in some it produced temporarily violent excitement. It cannot be recommended for private practice because of the possibility of its causing great excitement, the difficulty and expense of procuring the gas, and the awkwardness of conveying to the house the large quantity required, and the somewhat bulky mouth-piece.

[1] Archives de Tocologie, 1882.
[2] American Journal of Obstetrics, 1885.
[3] U. S. Dispensatory.
[4] London Medical Record, July, 1886.

Bromal.—This does not influence the uterine contractions; under its influence the breathing and pulse are unchanged, and the sensorium is almost unaffected. The abdominal pressure is strong and accelerates the birth, while there is no feeling of pain. But the bromal received into the blood is only slowly thrown off in the form of a gas, with a keen odor of leeks, from the breath not only of the mother but also of the child. The presence of bromal in the child's blood has not been found to have any bad effects. In many cases the patient requires to inhale but a very small quantity of the anæsthetic, and then the disagreeable after-effect is only slight. With nervous sensitive women, by whom the abdominal pressure is not exercised for fear of pain, the use of bromal will in many cases render the forceps unnecessary, and a labor that has been stationary for hours will be quickly and safely ended.

Chloroform.—Cohn states that this has been in general banished from obstetric practice for fear of its retarding the action of pains; but he adds that it is not correct to assume that a decrease of the intensity of the pains means a delaying of the birth. After having been brought slightly under the influence of chloroform by a few inhalations, the woman in labor feels no more suffering, but the contractions of the uterus, which involuntarily put the abdominal pressure into action, are perceived. In this way chloroform acts similarly to moderate doses of morphine and chloral; the latter, however, in larger doses reduces the intensity and frequency of the pains. Hence in cases of spasmodic labor-pains and threatened rupture of the uterus, he prefers morphine injections to chloroform. A fatal asphyxia occurring during the cleansing of the uterus after abortions, always at the beginning of the operation, seems attributable to the effect of the disinfecting injection, and not to the anæsthesia. In eclampsia continued slight narcotism accelerates the birth.

The great drawback to the use of chloroform is its effect on the child, which sometimes appears to be narcotized, and requires much time and trouble to be brought round.

Upon the whole, Dr. Cohn prefers chloroform to bromal. He allows a few drops to be inhaled when the pains first begin, and before the abdominal muscles begin to act and increase the pain. Forty grams will suffice in the case of a primipara to render the whole period of expulsion painless. To any one who objects to chloroform, he confidently recommends bromal.

Morphia and Chloral.—The administration of morphia, especially hypodermatically, is in some cases resorted to for the relief of very great suffering in childbirth, but usually in those where the pain is a manifestation of some pathological condition, and very rarely in physiological labor. On the other hand, chloral is frequently used in normal labor, some obstetricians regarding it as the best anæsthetic.

Chloral, though discovered by Liebig in 1832, was not used in medicine until 1869, when Liebrich showed some of its therapeutic properties. In December of the same year, the late Sir James Simpson[1] gave it to a woman in labor, and he stated that while relieving pain it did not retard or weaken uterine contractions. Further study of the action of chloral in childbirth was made by Lambert;[2] its use was advocated by Kidd,[3] and

1 Medical Times and Gazette, 1870.
2 Edinburgh Obstetrical Society's Transactions, volume ii.
3 London Lancet, January 21, 1871.

its indications were presented first by Pelissier[1] and afterward by Playfair;[2] an elaborate paper upon the uses of chloral was published by Kane.[3]

Dr. Playfair regards chloral as peculiarly adapted to the first stage of labor, especially suitable in those cases where the suffering is great, the os rigid and dilating very slowly or not at all. In his opinion nothing answers so well in cases of a rigid, undilatable cervix. He advises 15 grains of chloral every twenty minutes until three doses are given, this generally sufficing; the patient becomes quite drowsy, dozes between the pains, and wakes up as each contraction begins; it may be necessary to give a fourth dose at a longer interval, say an hour after the third, but rarely more than a drachm is required in the whole labor. It does not prevent the use of chloroform or ether in the second stage, but the quantity required of either is much less than if the chloral had not been given.

Kleinwächter[4] prefers chloral to all other anæsthetics; he gives it in a dose of one gram, or fifteen grains, every half hour until the suffering is relieved; it has no injurious effect upon the fœtus, deep narcosis is unnecessary, and the activity of the pains is unaltered. If it cannot be taken by the mouth, equally good effects follow its injection in the rectum.

Local Anæsthesia.—Friedländer[5] states that called to a woman in labor who was suffering from intolerable pain in the sacral region, he relieved her after various other means had been vainly tried by the application of a mixture of chloroform and ether, one part of the former and two of the latter. He repeated the experiment in a great many other cases, and found equally beneficial results.

Doléris[6] was the first to apply a solution of muriate of cocaine to the cervix and to the vulvar region in labor. He used a four per cent. solution, pencilling the surfaces with it; the experiment was tried upon nine women, and the result was satisfactory in six, that is, there was a notable alleviation of the suffering; the application was begun when the os was dilated to about the size of a two-franc piece. The three patients who had no relief from the cocaine had been in the clinique for several days, and consequently had had several injections of corrosive sublimate, and he supposed that the retention of some of this salt in the vaginal cul-de-sacs prevented action. The anæsthetic applied to the vulvar region just before the delivery of the head caused a remarkable diminution of the atrocious perineal pains without the progress of the labor being modified.

In February, 1885, I had some experiments made by the resident physicians in the obstetric department of the Philadelphia Hospital, using cocaine in a similar manner to that of Doléris, but the results were almost negative. It is very doubtful whether opening up the vagina and the exposure of the cervix necessary for applications of the remedy are entirely devoid of risk, especially when the use of one of the

[1] Des Indications de l'Hydrate de Chloral, 1873.
[2] London Lancet, February 21, 1874.
[3] American Journal of Obstetrics, 1881.
[4] Op. cit.
[5] Deutsche Klinik, 1874.
[6] Doléris made his report to the Paris Société de Biologie, January, 1885.

most potent antiseptics must be forbidden, according to the experience of Doléris, if benefit is to result from the former. Further, the application certainly will not be readily accepted by most patients, because of the exposure, and cocaine still is, and probably will always remain an expensive drug.

Having considered the subjects of anæsthesia and of antisepsis in obstetric practice, the special duties of the obstetrician will now be presented.

Prompt attendance is important when called to a case of labor, for though in most instances the call comes earlier than necessary, yet occasionally the presence of the obstetrician may enable him to easily correct an unfavorable presentation, which later may prove difficult or impossible, or arrest a dangerous hemorrhage, or ward off an attack of eclampsia.

The following articles should be carried by the accoucheur: A stethoscope, a flexible catheter, muriated tincture of iron, a preparation of ergot, a solution of morphia, or tablets for preparing such solution for hypodermatic use, and syringe, sulphuric ether, two or three long, straight needles with silk, silkworm-gut, properly prepared catgut, or silver wire, to be used if a tear of the perineum occurs, a silver female catheter, and if the patient lives at considerable distance, an obstetric forceps.[1]

If the patient has not already been provided with a fountain syringe, with an antiseptic solution, and an anæsthetic—chloroform, or ether, or a solution of chloral—the obstetrician should carry these too; on the other hand, if the anæsthetic selected be ether, and she has a supply, it will be unnecessary to include it in the list first mentioned. Upon arrival, it is better that he should not immediately enter the patient's room, even if previously knowing her; especially if a stranger, and taking the place of her expected attendant, his coming should be first announced, for an abrupt entrance may have an unfavorable effect upon her. Admitted to her room, it is rarely necessary for him to make an immediate examination, or even at once to inquire as to her present condition; for a time at least, it is better for him to get his information indirectly, by observing the character of her pains, their frequency, regularity, and the apparent suffering they cause. Let him so guard his words and acts that no offence be given to woman's modesty which is at once her ornament and defence. Physical suffering hushes the cry of shame, and until this occurs many a woman will shrink from a vaginal examination, especially if abruptly proposed. The obstetrician should be a gentleman, gentle in his ways and words, and yet firm in conduct; he among all men must have the *suaviter in modo* as well as the *fortiter in re*.

Siebold in one of his *Obstetric Letters*, in which the physician will find much instruction pleasantly given, says that the obstetrician must have a suitable sense of propriety, in order to observe all the laws of good

[1] The conservatism of Blundell did not permit taking instruments. "Lead not yourselves into temptation; if you put your instruments into your pocket, they are very apt to slip out of your pockets into the uterus."

manners, and give all possible protection to female modesty. LaMotte remarked that he should possess good manners, prudence, honesty, wisdom and secrecy; he ought to be religious and virtuous, and exempt from those great vices which in the sight of God and of the world, detract from the character of an honest man. Charpentier dwells upon patience, gentleness, coolness and decision, as essential qualifications of the accoucheur.

Two questions are to be decided by the professional attendant when in the presence of a patient supposed to be in labor. First, is she pregnant; second, has labor begun. A woman is very rarely deceived as to the fact of her own pregnancy, but occasionally she may have a false instead of a true pregnancy, and the physician must have the possibility of such occurrence in his mind. Provided the professional attendant does not already know, inquiry is made as to the date of the last menstruation, and as to that of "quickening;" so the question may be asked as to the premonitory symptoms of labor; if she has been previously confined, the character of the labor or labors should be ascertained. Next, inquiry may be directed as to her present condition, how long she has been sick, whether the "pains" are regular in recurrence, whether increasing in frequency and severity, and where they are felt; whether she has other suffering than that of labor, headache, for example, and whether there have been recent and free discharges from the

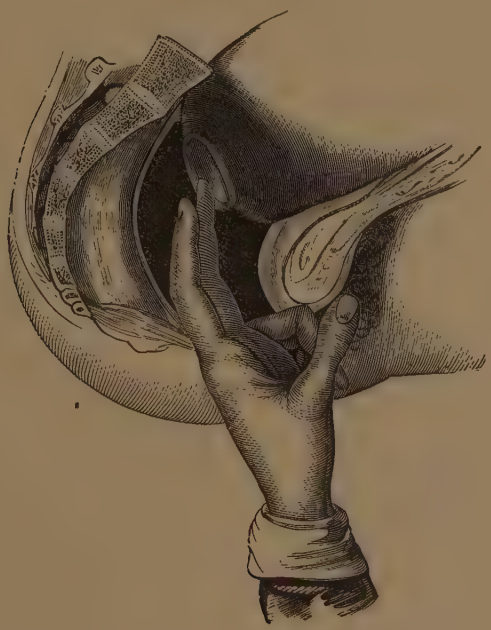
FIG. 142.

EXAMINATION IN LABOR WITH INDEX FINGER OF RIGHT HAND, THE OS UTERI JUST OPENING.

bladder and rectum. The necessity for an examination, if she does not already know it, is explained to her, and as a rule her consent is readily given. The physician retires from the room while the nurse makes the

necessary preparations by arranging the person and the clothing of the patient. Very commonly upon his return, the woman will be found lying upon the side with the hips near the edge of the bed, this position being taken as less offensive to modesty. Now, though the vaginal examination can be made in the majority of cases more satisfactorily when the subject is lying upon the back, and as this position, too, is essential for abdominal palpation, no fault should be found because she was placed upon the side; but if the examination as may be conveniently thus made is not entirely satisfactory, simply request her to turn upon the back and proceed again. After the examination—external, if necessary, as well as internal—the methods and purposes of which have been fully explained, and the physician finding a normal presentation with favorable position, vigorous and regular action of the uterus, and good condition of the birth-canal, he should frankly tell the woman and her friends that "everything is right," according to the stereotyped expression, or make some equivalent statement.

FIG. 143.



EXAMINATION IN LABOR WITH TWO FINGERS OF THE LEFT HAND, THE OS UTERI MORE DISTORTED.

Possibly the patient, after being informed of the favorable condition of affairs, asks how soon the labor will be over. The question is sure to come sooner or later, and to be anxiously and wearily repeated if the labor be long. Let the obstetrician beware of a positive answer, especially if it be the first stage of labor, and if a primipara, for the

remorseless clock may contradict his prediction at the sacrifice of all her hopes, and of her confidence in him. Velpeau remarked:—

> The accoucheur who, in order to make a show of vain wisdom, thinks himself capable of telling exactly when the labor will terminate, not only exposes his ignorance or his bad faith, but he compromises the honor of his art and the safety of his patient. Gooch, referring to parturition in a primipara, said, "I am never fool enough to state any time within which the labor will be over."

It sometimes happens that the first stage is brief and the second protracted; or, again, the first unusually long and the second very short, and hence any answer as to the duration of the labor, founded upon the presentation and position, the primiparity or the multiparity of the patient, the condition of the soft parts, the proportion between the presenting part and the birth-canal, derived from observing the rate of progress in a definite time, can only be a probability and an approximation to the truth, and should be so stated. Here, as in the general relations of physician and patient, the laws of truth must be observed, not that in all cases the patient is to be informed of any great peril that threatens her, but, on the other hand, let no falsehood ever be told her. Lying to patients, though the motive may be a kind one, never brings any good in the long run, and he who does it leads himself into temptation to be untruthful upon other occasions, even if he does not forfeit his claim to be believed in all matters, and loses his own self-respect, and also that of those who know him.

It is well to explain to her, if this is her first experience, the different stages of labor, the value of voluntary effort in the second, and its inutility and injury in the first period. Better, too, that she should know what she has to endure, and the greatness of her suffering be acknowledged, rather than treat it as being slight; and never endeavor to cheat her with false hopes and promises that will not be fulfilled. We are dealing with a rational being, and intelligent faith, will, and conscience are a stronger support in the endurance of great suffering than blind hope and unfulfilled promises.

Preparation of the Bed, and of the Patient's Person.—These duties are generally attended to by an intelligent nurse; but sometimes the nurse is not intelligent, or the patient may be too poor to employ one, or the labor end before her coming, and in such emergencies the practitioner must direct or make the necessary preparation of the bed. The bedstead should not be placed against the wall, but be accessible at each side; a firm mattress is placed upon it, and over the mattress a piece of rubber sheeting, oilcloth, or tarred paper to protect it from the patient's discharges, for these absorbed by it would cause both discomfort and danger. Above the protective material an old quilt or comforter, first folded lengthwise, and then transversely, is placed on that part of the bed where the patient's hips will rest, and above this a sheet similarly folded. Now let a sheet be spread in the usual manner upon the bed, then folded from below above so that the fold will come higher than the quilt and sheet which have been put in place; this sheet is thus arranged that it may be protected from being soiled during labor, and

after that has ended, and all wet clothes have been removed, it can be drawn down under the hips and to the foot of the bed, thus securing, with the least disturbance of her person, a dry, clean, and warm sheet to lie upon.

In some parts of the country it is customary to prepare a large muslin sac and half fill it with bran, which is placed under the hips of the parturient, and readily absorbs all fluids that are discharged; it is removed after the labor.

When the patient lies down, in the second stage of labor, her chemise and night dress should be drawn up above the hips, and a twice folded sheet pinned around the latter; this is far preferable to the skirt which is often worn at such a time, for the latter is not so easily removed, and its removal almost inevitably causes some soiling of the lower limbs. A piece of old carpet or of oilcloth is spread on the floor at that side of the bed upon which the patient lies.

Management of the First Stage of Labor.—During this stage, the presentation being normal, and the general condition good, the patient ought not to be in bed; sitting, walking, or standing is more favorable for the entrance of the head into the pelvic cavity than lying; moreover, if she is up now, the necessary confinement to the bed in the second stage of labor will be less irksome. She may be encouraged to engage in some light occupation or in cheerful conversation so that the time may not drag, and that her mind may in some degree be diverted from her suffering. Few persons should be in the room, and those only who are agreeable companions to her, and who will abstain from exciting her fears by the manifestation of great anxiety, by gloomy looks and untimely forebodings, or by narrating the misfortunes of other women in labor or in childbed. Her sympathies and her antipathies ought to be consulted in regard to those who are with her, and the obstetrician who knows how wisely to observe and judiciously to act, can often regulate this matter to the great benefit of the patient.

Condition of Bladder and Rectum.—If these organs have not been recently, and cannot be spontaneously, emptied, artificial means should be used. It very seldom happens that there is urinary retention, but accumulation of feces is common; the best means for the relief of the latter will be an enema of water, or of soap and water.

Food, Drink.—Usually there is very little desire for food during labor, but if it be protracted the patient should take nourishment in some form lest she become exhausted; she may have any simple food she desires, care being taken that the stomach is not overloaded. The most grateful drink will be cold water, and that may be taken freely. On the other hand, hot teas, so often in the country urged in domestic practice upon the parturient by injudicious friends with the purpose of "making the pains stronger," as well as alcoholic stimulants, ought to be forbidden.

Active Interference with the Process of Dilatation.—There is a notion[1]

[1] Some years ago I saw a woman who had a torn cervix and perineum, and she explained her condition as resulting from the fact that "the doctor opened" her "up too much" when she gave birth to her child.

on the part of some women that the doctor can and ought to render important assistance in the physiological processes of childbirth by mechanical or other means. Some doctors, too, advocate and pursue this practice. Gillette, for example, upholds digital dilatation of the os uteri, a practice which Baudelocque censured the *sages-femmes* of his day for doing, and a practice which Dr. Robert Barnes speaks of as "old and bad."

Dr. Gillette's method is described by him as follows:—[1]

"An anæsthetic is administered to the obstetrical degree, that is, just to the extent of dulling the pains; then during uterine contraction introduce two fingers into the os and expand them; or by hooking the forefingers on to the cervix make firm pressure, occasionally sweeping the finger around the whole cervical orbit." He believes that by following this plan he saves hours of agony to women, and avoids most of the dangers incident to protracted and powerless labor. Braithwaite[2] advises, in a prolonged first stage of labor, however, dilatation with one or two fingers of each hand placed back to back, at intervals of a few minutes, stretching the fingers apart, one moving backward, the other forward.

The danger of septic infection by these dilatations, as well as those of the vulva, and by all unnecessary examination and manipulations, have been strongly presented by Spiegelberg in considering the prophylaxis of puerperal septicæmia. "Care must be taken that labor go on as simply as possible; manipulations in the genital passages are to be made only when absolutely necessary. . . . Nothing is more objectionable and more repulsive than the almost incessant exploring and manipulating in the vagina, the os uteri, and the vulva, which most midwives are in the habit of doing when the labor does not progress as rapidly as they desire. . . . . The danger in this for the puerpera cannot be too strongly emphasized."

In conclusion, the student may be assured that digital dilatation of the os uteri, or of the os vulvæ, is rarely necessary, in most cases does no good, and in some may cause great evil.

Among other means resorted to for shortening the first stage of labor may be mentioned the administration of ipecacuanha in an emetic dose, a practice which was never common, and which is now becoming almost unknown, and the application of belladonna to the cervix, or, as advised by Horton,[3] the injection of a solution of atropia into its substance. I can say nothing in favor of any of these means from personal experience, but my belief is that in normal labor they are at least unnecessary.

It sometimes happens, especially in a primipara, when the suffering is very great, if chloral or anæsthetic inhalation is not used, a hypodermatic of a solution of morphia has both a general and local favorable effect.

Presence of the Physician.—It is not advisable for the physician to remain constantly in the room during the first stage of labor; an occa-

[1] Transactions of the American Gynecological Society, vol. vii.
[2] London Obstetrical Society's Transactions, vol. xxi.
[3] American Journal of Obstetrics, 1878.

sional absence gives the patient an opportunity to evacuate the bladder, to make changes in her clothing, or attend to other matters which might be prevented by his presence. Further, if he constantly stays in the room she may anticipate a speedier termination of her labor than is possible, or she may think her condition serious; beside this, he may be appealed to by her or by her friends to render some supposed assistance, which may be very injudicious or even injurious. In many cases it is not necessary for him even to remain in the house, and he may take the opportunity to visit other patients; but it should always be known where he can be found, if any emergency arise, demanding his immediate presence. A physician may exhaust his strength by too constant attendance, and too assiduous attention during the first stage of labor, and by denying himself needed sleep, so that when some serious difficulty arises in the second or third stage, he may lack the clear head, the firm hand, and the physical endurance upon which the salvation of his patient or of her child rests.

Management of the Second Stage of Labor.—The uterine contractions are gradually reinforced by voluntary efforts, and the first usually passes into the second stage of labor by a slow transition. The patient now goes to bed, her clothing being arranged as has been mentioned; but if a primipara, or if the labor be slow, it is not necessary for her to remain constantly lying down; occasional sitting up, or taking a few turns in the room, will give her some rest, and also may hasten delivery.

At the beginning of this stage the bag of waters usually ruptures; if it does not, it is advisable to rupture it, and this may generally be done by pressing the finger firmly against it during a uterine contraction; if such pressure does not succeed, a few notches may be cut in the finger nail, making a saw of it, which may then be thus used against the tense membranes. Immediately after the escape of the amniotic liquor, a vaginal examination must be made, in order to confirm, in some instances possibly to correct, the diagnosis of presentation and position that has been made, or to make this diagnosis if it has been hitherto impossible, and to ascertain any change of position, or any increase in descent of the presenting part, which in a multipara may sometimes become very rapid immediately after the evacuation of the fluid; so, too, this examination is now necessary, in order to ascertain whether prolapse of the cord, or of one of the upper or lower limbs, has occurred.

Position of the Patient.—It varies in different countries, but with us she usually lies upon the back, or upon the left side. Until the head rests upon the pelvic floor the most favorable position during a pain is one between sitting and lying, the feet pressed against a firm object, or the bent knees fixed by the pressure of the hands of one of the attendants, the upper portion of the trunk drawn forward by the patient grasping the hands of the nurse or a sheet or towel fastened to the lower part of the bed for this purpose, and the chin turned to the chest. A kneeling[1] or squatting position is the most favorable for

[1] Kleinwächter.

the expulsion of the child, but the child may be injured, the perineum cannot be protected, the liability to hemorrhage is greater, and it is impossible to properly manage the third stage of labor, as well as difficult to put the patient in bed. When lying upon the left side the usual right obliquity of the uterus is corrected, and in this regard the uterine force acts more advantageously; the abdominal pressure, however, is less, and the general force is directed too much in the direction of the axis of the inlet, that is, towards the fundus of the pelvic cylinder, whereas the line of exit for the fœtus is nearly at a right angle to that of entrance. Many women prefer the side position because of the relief to pain in the back which firm pressure of the hand upon the sacrum gives; such pressure, of course, cannot be made when the patient lies on her back. Schroeder has proved that rupture of the perineum is more frequent in women delivered upon the back than in those delivered upon the side, and therefore the latter position should be taken in all cases where there is danger of such rupture, as soon as the head begins to press upon the pelvic floor. In this position too, visual examination of the perineum, should it be necessary, is possible.

Condition of the Child.—Occasional inquiry may be made of the patient as to her being conscious of the movements of the child. But a more certain way of learning its condition, either in the first or second stage of labor, is by auscultation. The first indication[1] of the suffering of the child is shown by a greater rapidity of the cardiac pulsations; then, if this state continues, to the acceleration which appears at first there succeeds a slowing, which becomes more and more decided as the fœtal life is more and more compromised. At the same time that these variations are observed and irregularities are produced, the intensity of the *bruits* lessens. Whenever, says Depaul, the cardiac pulsations fall below 100, and especially below 80, the condition is a very serious one, and if possible the accoucheur ought to intervene and end the labor.

Condition of the Os Uteri.—As has been stated, the rule is that in the first stage of labor attempts to dilate the os uteri by the fingers should not be made; so, too, they are usually not required in the second stage. But as it sometimes happens that in the former the force of the uterine contractions is in part lost in consequence of the os being directed too far posteriorly and to the side, and it may be then advantageous to hook the fingers into the os during the absence of a pain, and draw it toward the centre of the pelvic cavity, keeping it in this position during a contraction, so in the second stage the anterior margin of the os may be found closely applied to the fœtal head while the posterior has receded, hence liberation of the former is indicated. The part of the fœtal head in front descends at each contraction, hooded by the anterior portion of the dilated cervix, and this portion thus compressed between the head of the fœtus and the pelvic wall is liable to become swelled and œdematous. Therefore, by the advice of the most conservative obstetricians, this part may be pressed up, in the

[1] Depaul, op. cit.

interval of contractions, by one or two fingers, and thus held during a uterine effort; sometimes the head immediately passes the obstruction, but in others it may be necessary, once or oftener, to repeat the proceeding. Let it be remembered that this manœuvre, which is seldom necessary, must be done without violence.

Cramps in the Lower Limbs.—Cramps affecting the thighs or legs sometimes cause great suffering; they occur in the second rather than in the first stage of labor, and are attributed to pressure and dragging upon certain nerves of the pelvis, branches of the sacral plexus, the sciatic, the obturator, etc. Rubbing the affected part with the hand, change of position, or the use of an anæsthetic will give relief.

Food, Drink, etc., Preparation for Delivery.—Unless the second stage be unusually long the patient rarely desires or needs nourishment; a full stomach will hinder the needed voluntary efforts during a uterine contraction; if food is given, only a small quantity is advisable, and it should be simple and easily digested. Now, as then, cold water may be given freely. Frequently bathing the patient's hands and face with cold water will in most cases be both agreeable and refreshing.

As the second stage approaches its end, hot and cold water, an alcoholic stimulant, scissors, and a string for tying the cord are to be at hand.

Pressure of the head upon the rectum often causes a factitious desire to empty the bowels, and the patient insists upon getting up for this purpose; but she must be refused, for the child might be born while she was on the commode or in the water-closet.

Care of the Perineum.—Usually the most important of the obstetrician's active duties in the second stage of labor is protection of the perineum from being torn during the delivery of the head and shoulders of the fœtus, or if a tear is inevitable, cause that to be as slight as possible.

Matthews Duncan has suggested that in the Darwinian progress of the species, the head of the fœtus has increased in size more rapidly than the orifice through which it has to come has increased in size and dilatability. Be this as it may, both he and Schroeder have shown that in primiparæ some tearing of the vaginal orifice is inevitable, and the rent may involve the perineum, only 39 per cent., according to the latter, escaping rupture of the fourchette. Not only injury of the posterior portion of the vulva, but also of its anterior may occur, and rents here may cause very serious hemorrhage. But the perineum is especially liable to tear from the direction of the force which propels the child through the birth-canal; the perineum is a resisting wall designed to direct the fœtus toward the opening in the anterior wall of the dynamic pelvis. When the perineal wall gives way, the rent generally occurs in the median line, for there the distension is greatest and the tissues are furthest from their points of attachment. Even if the perineum receives no immediately apparent injury, it may have been subjected to pressure for so long a time and been so greatly stretched that, though entire for some days after delivery, it finally gives way, and the condition is then similar to

laceration. Hibberd[1] has reported two cases of the kind, and Duncan[2] previously directed attention to the fact, but a case of such injury was first described by Dewees.[3]

Frequency of Ruptures of the Perineum.—Taking hospital statistics rather than any derived from private practice, it is probable that the perineum is torn more or less in 20 to 30 per cent. of primiparæ, and in 5 to 10 per cent. of multiparæ.

Causes.—Without referring to special conditions of the parts that are torn creating a liability to the accident, or the form of the pelvis, or certain presentations and positions, it may be in general stated that the great majority of perineal tears occur from too rapid deliveries, the child being expelled before there is sufficient dilatation of the vulvo-vaginal opening; the force is too great, and the time too short, so that soft parts are not stretched but torn.

Prevention.—It follows from the statement just made that, to prevent tearing of the perineum, or to make the tear as slight as possible, if some injury be inevitable, the most important means are to hinder abrupt expulsion of the fœtus, and to promote gradual dilatation of the part it traverses. In attaining these objects one of the first things to be done is to have the patient lie upon her side, preferably the left side. The advantages of the lateral position are lessened abdominal pressure, preventing the wide separation of the thighs, and in this position the condition of the perineum may be known by actual inspection. There must be no pressure against her knees, and any object against which her feet may push, should be removed; she should be directed to take frequent respirations, and to refrain from all bearing-down efforts; if such efforts cannot be thus prevented, an anæsthetic may be given. A doubled pillow or a quilt made into a roll may be placed between her knees. If the dilatation of the vulvar opening be insufficient the head must be held back by direct pressure, and, when it is finally expelled, it should be guided during the expulsion in the axis of the opening. Hohl directed grasping the head, after the occiput has passed under the pubic joint, with the hand, the thumb above, the fingers below reaching to the anterior margin of the perineum, and thus holding the head back during a pain. Others apply pressure to the head with one hand, while the other is used to support the perineum in a manner to be presently described. Kleinwächter states that we have in the forceps an excellent means for regulating the descent of the head and giving the soft parts time to dilate; Barnes suggests that occasionally the long double curved forceps, by carrying the head well forward, may preserve the perineum.

A brief statement of various other means that have been or are employed for the protection of the perineum, is here presented. Some have sought to give more material to the perineum by pressing the tissues from about the anus, or from the thighs, the latter was advised by Siebold, toward the vulvar orifice; but this method adds nothing to the muscular and fibrous tissues of the perineum. That manipulation which Playfair calls "relax-

[1] American Practitioner, 1881. [2] Papers on the Female Perineum, 1879.
[3] System of Midwifery, eighth edition, p. 287, 1837.

ing the perineum" is really founded upon the principle just mentioned. He describes it as follows:[1] "If, when the head is distending the perineum greatly, the thumb and forefinger of the right hand are placed along its sides, it can be pushed gently forward over the head at the height of the pain, while the tips of the fingers may at the same time press upon the advancing vertex, so as to retard its progress if advisable. By this means the sudden and forcible stretching of the perineal structures is prevented, and the chance of laceration reduced to a minimum, while nature's plan of relaxing the tissues, by dilatation of the anal orifice, is favored." Smellie[2] advised, not however for the protection of the perineum, but in certain cases where the head was drawn back after a pain, by the cord being around the child's neck, or by the shoulders being retarded at the brim of the pelvis, or when the mouth of the womb contracted around the child's neck, that one or two fingers be introduced into the rectum before the pain goes off, and pressure be made upon the forehead of the child at the root of the nose; this measure retains the head till the return of another pain which will squeeze it farther down, while the fingers pushing slowly and gradually turn the forehead half round outwards and upwards. Ritgen, and more recently Olshausen, have commended this method for the purpose of protecting the perineum.[3] The patient may be upon her back or upon her side, but the latter position is preferred; the index and middle fingers are passed as far as possible into the rectum, and pressure made upon the forehead of the child, while the thumb is close to the fourchette so as to control that part of the head already born; as the head emerges pressure is made upon the superior, then upon the inferior maxilla, until the head is quite pushed out. The protection to the perineum is in enucleation, shelling-out the head in the interval, and not during a pain. It is somewhat remarkable that Nicolo Bernati, as early as 1778,[4] advised protecting the perineum by a finger in the rectum. Dr. Lusk[5] states that in cases of rigidity of the perineum he is in the habit of "alternately drawing the chin down through the rectum until the head distends the perineum, and then allowing it to recede;" he further claims that "the parts become rapidly distensible by this to-and-fro movement."

Dr. Goodell advises hooking the fingers into the rectum, and drawing the perineum forward, while the thumb on the head restrains, if necessary, its advance. Doléris[6] has recently advocated the method of rectal expression, which, as we have seen, seems to have originated with Smellie, or rather with Bernati. The following direction, given by the Salernian school, for preventing injury to the perineum, involves the same idea—that of pressure of the head from the rectum. *Præperetur pannus in modo pilæ oblongæ et ponatur in ano.*

Dilatation is a very old practice, at least as old as the times of Ætius and of Avicenna, for each taught that this structure was to be kept from injury, *versus os sacrum reprimendo perinæum.* Dr. John Harvie, chiefly famous for having married the niece of Smellie, and being his successor as a teacher of midwifery in London, sought to save the perineum by preventing its "lengthening," and to this end directed that it should be "by the palm of the left hand pretty strongly carried back toward the anus, and kept so all the time of every pain."[7] Pugh[8] taught that the vulva was to

1 Op. cit. 2 Midwifery. 3 Kleinwächter.
4 Brevi Intruzioni de l'Arte Ostetricia, Trevis, ii., 1778. 5 Op. cit.
6 Nouvelles Archives d'Obstétrique et de Gynécologie, 1886.
7 Practical Direction, showing a Method of Preserving the Perineum in Birth, etc. London, 1767.
8 Treatise on Midwifery, London, 1754.

be dilated by the fingers, "stretching lengthways when the pains are off, circularly when the pains are on."

Dr. Reamy has the patient lying across the bed, her hips close to its edge, the thighs and legs flexed, and the knees brought close together, and an assistant on each side keeping the limbs in this position. The assistants are given the opposite ends of a towel or bandage of linen, about ten inches wide, and forty to fifty inches long, which is carried around the buttocks and spread out smoothly, with its upper or anterior edge on a level with the fourchette. The assistants are directed "to make traction during the pains, in such amount, in such direction, and with such part of the bandage as the accoucheur may direct."[1]

Dr. Price states: "I have recently used a towel about four feet long, folded lengthwise to a width of six inches, passed in front of the pubes and over the trochanters, the free ends secured by two strong safety-pins over a firm pad resting against the os coccygis and the anal orifice. The effect of this is to crowd the surrounding tissues in the direction of the vulvar outlet, securing all the relaxation that is possible, at the same time keeping the head pressed toward the pubic arch. The action of this pad and band is pleasant to the patient, and effectually protects the coccyx from injury, which, as is well known, is often the cause of that most serious malady, coccygodynia. At the moment of greatest distension the action of the band should be aided by the left hand of the accoucheur, while the other resists the too rapid advance of the head by direct and firm pressure."[2]

Engelmann, as one of his reasons for regarding the semi-recumbent position in labor as the most serviceable, and that which should be adopted as the obstetric position in all ordinary labor cases, makes the following statement: "The perineum has a certain support which does away with the questionable proceeding of supporting the perineum during the expulsion of the head and shoulders, by which more harm than good is usually done."[3]

Mossman advocates "prophylactic manual dilatation." He directs one or two fingers to be introduced into the vagina in the interval between pains, and to press forward and downward.[4] Duke draws back the perineum with the left thumb, or with the first two fingers of the right hand, during a pain; this method is begun as soon as the head is engaged in the pelvic cavity, and is advancing with each pain.[5]

The use of the fingers in the rectum, although advocated by some eminent obstetricians, is rejected by the majority of authorities. Naegele and Grenser regard it as painful or injurious; Kleinwächter states there is danger of injuring the rectum, and it is not to be recommended; Duncan says that it it is neither safe nor desirable, and refers to a case in which a recto-vaginal fistula was thus caused;[6] Tarnier believes it is painful, and does not give better results than other methods; Playfair characterizes it as "repugnant both to the practitioner and patient." A further objection to it is that the presence

[1] Transactions of the American Gynecological Society, vol. x.
[2] Transactions of the Medical Society of the State of Pennsylvania at its thirty-fifth annual session, 1884.
[3] Op. cit.
[4] American Journal of Obstetrics, 1880.
[5] British Medical Journal, 1883.
[6] Edinburgh Obstetrical Society's Transactions, vol. iii.

of the fingers in the rectum is very liable to add to the reflex excitability, thus increasing the force of "bearing-down efforts."

Depaul[1] gave as an objection to supporting the perineum the fact that the first effect is to hide the part which it is advisable to inspect; the practitioner, believing in complete security, is deprived of certain indications which announce the imminence of danger, and very considerable rents occur under his hand which might have been avoided if a different course had been taken. He urged that attention should be given, not to increasing the resistance of the perineum, but to giving it time for being gently stretched; all our care is to be directed to this, which requires a certain time. Moderate the expulsive efforts if they are too violent, hold back the head when it receives too strong an impulsion; this is the secret of being master of the situation, and of doing something really useful.

But supporting the perineum is, as Matthews Duncan has remarked, a practice upheld by the majority of obstetricians, both now and in past times. It is not likely to be abandoned, nor do I believe it can be replaced by rectal expression, or by hip-bandages. Substituting "perineal relaxation," and denying that the perineum can be supported seem to me errors.

In many cases the condition of the perineum as to ready dilatability is such, the expulsive force acts so regularly and moderately, and the relation of the object to be expelled is so adapted to the outlet of the birth-canal, that there is no danger of injury to the perineum, and therefore no effort should be made to support it; the obstetrician's only duty then is to receive in his hand the head of the child as it is expelled. But in other cases the following plan may be followed: Supposing the patient to be lying upon her left side, as she usually will be if rupture of the perineum is feared, and her hips quite near the edge of the bed, the practitioner places his right hand so that the concave palm receives the convexity formed by the bulging perineum; the thumb is upon the right, and the four fingers upon the left labium majus, while the fold between the thumb and index finger corresponds with the anterior margin of the perineum. Moderate resistance is made to the force driving the head against the perineum, and at the same time the head is gently pressed toward the pubic symphysis; strong pressure is to be avoided, because if the perineum be very thin, such pressure at this thinned part may cause a central tear. No napkin should be interposed between the hand and the perineum; the hand should not be applied until perineal distension begins, and it should be applied only during a pain. The left hand is passed over the patient's upper thigh, and grasps the fœtal head in the manner directed by Hohl, holding it back when necessary, and at the proper time guiding its exit in the axis of the vulvar orifice, and facilitating extension.

As to pressing the perineum forward, or drawing it back, it is to be borne in mind, as Garrigues[2] has said, that the vulvar orifice is a ring

[1] Dictionnaire Encyclopédique des Sciences Médicales.
[2] American Journal of Obstetrics, April, 1882.

through which the fœtal head, now moulded into a cylindrical form, must pass, and that a cylinder will pass through a ring most readily when the latter is at a right angle to the former. "Only if this relation between them does not exist, can it be of use to displace the posterior part of the ring forwards or backwards, according to circumstances."

Support of the perineum must be continued during the passage of the shoulder, lest a new rent be made, or a slight one caused by the expulsion of the head, be increased; in frequent cases a perineum which has been saved from injury during the passage of the head, is seriously torn when the shoulders are born, and therefore proper care should be taken to prevent such accident.

Episiotomy.—If a serious tear of the perineum seems inevitable, it is generally advised that an incision or incisions be made to prevent this accident. This practice, though generally credited to Michaelis, 1810, was recommended by Ould,[1] 1742.

Opinions differ as to the necessity for incisions, and also on the part of those who approve of the operation as to where they should be made. The late Dr. A. H. McClintock stated that he had so often seen the perineum escape laceration where this accident seemed inevitable, he was led to doubt the possibility of recognizing the cases where incision is an absolute necessity. Playfair asserts that when a distended perineum ruptures, its structures are so thinned that the tear is always linear; and, as a matter of fact, the edges of the wound are always as clean, and as closely in apposition as if the cut had been made with a knife. This statement may be received with some doubt, even by those who have never examined a recent tear of the perineum.

The incisions usually recommended are lateral. Tarnier, however, states that they do not always prevent even quite extensive tears, and they may leave deformity and a painful cicatrix, or the duct of one of the vulvo-vaginal glands may be divided, and a fistula result. He therefore advises an incision of the perineum, beginning at the raphe, and then not passing directly back, but turning obliquely to one side, so that if a laceration follow, it cannot involve the same sphincter. He cautions again episiotomy, unless it is quite indispensable, for he has sometimes seen the incised parts covered with eschars, and become the medium of grave infectious accidents.

Delore, in referring to the lateral incisions advised by Dubois, states that he accepts in extreme cases this slight operation, but in ordinary

[1] "It sometimes happens, though the Labor has succeeded so well, that the Head of the Child has made its Way through the Bones of the Pelvis, that it cannot however come forward, by reason of the Extraordinary Constriction of the external Orifice of the Vagina; so that the Head, after it has passed the Bones, thrusts the Flesh and Integuments before it, as if it were contained in a Purse; in which Condition if it continues long, the Labour will become dangerous, by the Orifice of the Womb contracting about the Child's Neck; wherefore it must be dilated if possible by the Fingers, and forced over the Child's Head; if this cannot be accomplished, there must be an Incision made toward the Anus with a Pair of crooked Probe-Sizars; introducing one Blade between the Head and Vagina, as far as shall be thought necessary for the present Purpose, and the Business is done at one Pinch, by which the whole Body will easily come forth."—*A Treatise on Midwifery.* By Fielding Ould, Man-Midwife. Dublin, 1742. Ould also advised stitching the wound if the incision be made so near the "Rectum as to weaken its Contraction."

cases it is preferable to have a median rent, which cicatrizes uniformly, than two lateral ones which result in deformed cicatrices.

It may be stated that episiotomy will very seldom be plainly indicated, and in private practice will rarely be done.

Dr. Broomall[1] regards episiotomy as a safe and justifiable procedure, when the perineum is threatened, and where the danger of deep laceration is evident, as the proper and indispensable means to be used with the hope of meeting that danger. She advises a probe-pointed curved bistoury to be used; the blade is slipped between the fœtal head and the lateral margin of the vaginal orifice, and its cutting edge directed during a pain toward the tuber ischii; the incision is made at a point one-third the distance from the posterior commissure to the clitoris; the length of the incision never exceeded 1.5 centimetres. A similar incision is made, if necessary, at the opposite side; after the labor, the edges of the wounds are united by silk sutures. Dr. Manton[2] strongly advocates episiotomy, claiming that it diminishes the frequency of perineal ruptures to a minimum. He also operates with a probe-pointed bistoury, and makes an incision from 1 to 3 centimetres long, first on one, and then, if necessary, on the other side; he thinks it better not to include the external skin in the incision, although no harm is done should this take place.

Delivery of the Shoulders.—Immediately after the head is expelled and rests in the hand of the accoucheur (Fig. 122), a finger is passed to the neck of the child to find if the cord encircles it, an accident occurring once in five cases; if this be the case, the loop should be enlarged, the head flexed, and an attempt made to draw the cord over it; should the attempt fail, the shoulders are to be delivered through the loop. In some cases the cord encircles the neck not only once but even three or four times, and the coils may be so tight that dividing the cord is necessary; if this be done, it is advisable, unless the fœtus is immediately delivered, to tie each end of the severed cord.

Moderate pressure is made upon the patient's abdomen during the expulsion of the body, the hand so placed that it "follows down" the uterus as it descends with the discharge of its contents, in the abdominal cavity. The shoulders are usually delivered soon after the head, any delay can generally be remedied by moderate manual pressure or friction of the uterus through the abdominal wall; it may be advisable in some cases to turn the head of the fœtus with the occiput toward the mother's left or right thigh, according as the position was left occipital, or right occipital, thus having the external rotation of the head invite and correspond with the internal rotation of the shoulders; then let the head, still held in the hand, drop down so that slight traction is exercised upon the anterior shoulder, which may be thus liberated. After the anterior shoulder comes in the pubic arch, the head is to be carried up towards the mons veneris, slight traction being made, when the posterior shoulder will be delivered; the injunction may be repeated, that during the delivery care must be taken that the perineum escapes injury.

[1] American Journal of Obstetrics, 1878. [2] Ibid., 1885.

Difficult Delivery of the Shoulders.—In some cases, however, the delivery of the shoulders cannot be thus accomplished; the body is very large, and the fœtal circumference of the shoulders and chest much greater than usual, while the *vis a tergo*, the uterine and abdominal contraction may fail. Danger comes to the child from compression of the chest, or of the cord which may encircle the body, and death is inevitable unless speedy delivery can be effected. One of the ways which may be quickly tried, is to exert traction with the hands applied to the sides of the child's head. Even if we cannot complete the delivery of the shoulders in this way, we may advance it so far that a finger can be readily introduced into the axilla of the perineal shoulder, and then pull with this finger; or traction may be made with the fingers in each axilla. Jacquemier advised bringing down the arms, upon which traction can be made, and beside when they are disengaged the size of the chest is lessened. Although the practice is indorsed by Charpentier, he acknowledges that in one case he fractured the humerus; if there be room for this manipulation, there is room, as Spiegelberg taught, for delivery by other methods, and it may be rejected. Hodge advised pushing the anterior shoulder in behind the pubic joint, then bringing the neck of the child in the pubic arch, so that its side presses against the subpubic ligament; by this means the posterior shoulder is brought to the margin of the perineum; when such change has been effected, the head is carried backward, and the anterior shoulder again comes just outside the pubic arch, and delivery is usually easily effected. This plan was also advised by Spiegelberg. Occasionally it may be necessary to use a blunt hook, instead of the finger, to exert traction from the axilla; one must be careful, however, not to act upon the humerus on account of risk of detachment of the epiphysis; after either traction by finger or blunt hook, temporary paralysis of the arms may occur. Of course the patient should be urged to "bear down," and uterine action may be stimulated by friction and assisted by external abdominal pressure.

Delivery of the Rest of the Body.—After the delivery of the shoulders the remaining portion of the body is usually very promptly expelled; but if it is not, and immediate delivery is necessary, the hands should grasp the thorax, and with gentle traction the process is completed. It is very much better, however, in most cases, to trust the expulsion of the child to the uterus.

Attention to the Child.—The child is laid upon the bed near the side, not so near that by any sudden movement it may roll off, and not so far from the mother that there is any dragging upon the cord; it is placed where it can get air, and in a position in which it will not be bathed in the fluids that often make a pool about the mother's hips. It usually at once breathes freely and cries vigorously; if respiration be hindered by accumulation of mucus in its mouth, the secretion should be wiped away by the finger covered with a little soft muslin. In case respiratory efforts are feeble or absent, they generally may be quickened or excited by dashing one or two teaspoonfuls of cold water upon the chest, or friction of the chest may be made by the obstetrician with one of his hands upon which a small quantity of spirits of camphor has been poured.

It was the custom of Mauriceau, Clement, La Motte, and Deventer,

indeed, of the old obstetricians generally, not to tie the cord until the placenta was expelled; Zweifel has revived this practice. Most obstetricians, however, are in the habit of applying a ligature to the cord as soon as the child breathes freely. Some experiments, made by Budin[1] in 1875, in immediate and late ligation of the cord, proved that when the latter plan was followed the infant received a large quantity of blood, the average was 92 grams, and thus immediate ligation deprived the infant of this. In March, 1885, he stated that almost all contributions to the subject, published in different countries, confirm the general conclusion which he had previously reached, viz., ligation and section of the cord should not be done until after complete cessation of the vascular pulsations of the cord. Not merely is the child by late ligation secured a notable amount of blood otherwise left in the placenta, but its subsequent condition is more favorable, it loses less weight in the first days following birth, and acquires weight more rapidly than a child in whose case immediate ligation was done. These were the conclusions not only of Budin, but also of Ribemont, Schücking, Zweifel, and of most who investigated the subject. The matter has been studied anew by Engel.[2] He observed that the pulsations in the cord continue for some minutes, or even for a quarter of an hour, after birth. He found that late ligation secured to infants born at term 70 grams, but to premature infants 90 grams. Engel failed to discover any relation between loss of weight in the first days after birth, but his statistics prove that late ligation secures increased vitality to the infants. Thus the mortality of premature infants when immediate ligation was done was 18.88 per cent., but with late ligation only 9.45 per cent. The causes of the increased quantity of blood entering the fœtus are thoracic aspiration and uterine pressure.

In regard to waiting until all pulsation has ceased, one might, in some cases, wait until all patience as well as pulsation had ceased; for example, La Motte[3] mentions going to a woman who had been delivered *trois grosses heures* before his arrival; the child was lying between the mother's thighs, the placenta undelivered, and "the beating of the cord was of a marvellous force." Probably it is not necessary nor advisable to make an absolute rule that pulsation must cease before tying; when the child breathes freely and the pulsation lessens in force, one need not wait.

Various material has been used for tying the cord. The late Dr. Bedford preferred tape, believing that if a round string was used the child was more liable to trismus. Dickson[4] first advised the elastic ligature, and Tarnier uses it in addition to the ordinary ligature. A few strands of hemp thread answer the purpose quite as well as any material. Whatever is used, it ought not to be so thin as to risk cutting the cord, or cutting the physician's fingers when he is drawing the knot. The ligature is placed about three fingers' breadth from the umbilicus; the string or tape is passed under the cord, the ends

[1] Obstétrique et Gynécologie, Paris, 1886.
[2] Centralblatt für Gynäkol., 1885.
[3] Observation ccxxx.
[4] Proceedings of Edinburgh Obstetrical Society, January 14, 1874.

brought above and tied, gradually and firmly compressing the cord so as to force away at the place of constriction the gelatinous portion, with a surgeon's knot, and then a single knot. The cord should be tied again at a distance of two inches from the first ligature and toward the placenta. The reasons for the additional ligature are, first, cleanliness, and, second, it is probable, not however proved, that a placenta when only partially emptied of blood is more easily detached by uterine retraction than one which is flaccid, and hence which may more readily follow the lessened size of the uterus and diminished surface of attachment without separation. In multiple pregnancy the second ligature is required because of the possible vascular connection between the circulation of the two fœtuses in the placenta. After ligation the cord is divided between the two ligatures, care being taken to leave a large button-like projection at the fœtal portion especially, so that the ligature cannot slip off; blunt-pointed scissors are best for making this section, and the obstetrician must be watchful lest a finger or some other part of the fœtus be included with the cord between the blades. After the section let the cut surface of the fœtal part have a soft rag pressed upon it to dry it, and then watched for a minute or two to see if there be any oozing of blood; if there be, another ligature should be immediately applied.

The obstetrician now hands the child to the nurse, who has a small blanket or shawl, which has been warmed for its reception. In handing it to her he either places the right hand under the shoulders, the thumb and index finger supporting the head, and the left hand holding the ankles; or, as taught by Dr. Hodge, he embraces the thorax of the infant with the right hand extended so that the palm is over the sternum, the thumb under the right axilla, and the fingers under the left, and the head falls toward the sternum; this is a natural position for the child, the practitioner has a firm hold, and the left hand is left free for any required assistance. Trivial as these directions may seem to the student, yet in practice he will find that attention to the little things has much to do with the obstetrician's success.

Washing the Child and Dressing the Cord.—Though washing the infant and dressing the cord are usually done by the nurse, yet occasionally one or both of these duties may devolve upon the doctor, and even if this not be the case, he ought to know how they are best done. There are needed for the washing, a soft sponge, a piece of old linen or cotton cloth, water at a temperature of 90° to 96° F., some oily substance, such as unsalted butter, lard, sweet oil, or vaseline; or, instead of any of these, the yelk of a fresh egg, and Castile or some one of the finer soaps, or transparent glycerine soap is good. The oily matter, or the egg-yelk is used for the purpose of facilitating the removal of the *vernix caseosa*, and the body of the child is first rubbed with one of these substances. The face is now washed with warm water simply, no soap being used, lest some of the soapy water should get into the infant's eyes, causing pain, and possibly a conjunctival irritation which may result in inflammation; children of a larger growth will strenuously object to soap-water for washing their eyes, and let the infant be treated as kindly. After washing and drying the face, the body

and limbs are washed with soap and water, and well dried; the washing of course must be done in a warm room, quickly, avoiding prolonged or unnecessary exposure of the child, and with gentleness, care being taken not to irritate the sensitive skin by rude rubbing, even though one portion of the vernix caseosa may remain, for it will dry up in a day or two, and be spontaneously detached, or can be removed at a subsequent washing. After drying the infant, powdered starch is dusted over the surface, especially at the flexures of the knees, thighs, and elbows, and in the axillæ.

The common method of dressing the cord is this: A square piece of old linen, a little more than twice the length of the attached cord, is slightly scorched, a hole cut in its centre, and mutton suet put upon its under surface; the cord is passed through the hole, then the linen folded first transversely, and afterward from side to side, over the cord so that the latter is completely wrapped. Dr. Babcock, of Evansville, Indiana, recommended covering the cord with absorbent cotton, and the method has been commended by Lusk. Goodell advised squeezing out Wharton's jelly from the cord, and this certainly seems to me best. When the duty of caring for the cord devolves upon the practitioner, he may pursue the following plan: Let him take a piece of soft cotton rag, place it upon the cord, and grasp the latter just below where it has been tied with the thumb and the fingers of the left hand; now cut off the cord at the point of ligation, and then squeeze out all of Wharton's jelly upon the rag, and in a minute or two the cord is reduced to half its former size, and instead of being a solid cylinder, is a limp, riband-like body. A new ligature is now applied, and bleeding is impossible. A little iodoform or salicylic acid may be sprinkled upon the cord, and then it may be encircled with a few turns of a linen or muslin bandage, an inch to an inch and a half in width, which is fastened by a silk or hemp thread tied around it. No subsequent dressing is needed; the cord and bandage will fall off together in a few days. The advantages of this plan are the comfort of the child, absolute security from hemorrhage, and the lessened mass to be detached. Carbolized cotton is applied to the cord by Dohrn, salicylated cotton by Fehling, and salicylic acid in powder sprinkled upon the umbilical region.

Dressing the Child.—The "belly band," which is almost universally used, should not be tight, for the increase in pulmonary capacity in the new-born is chiefly due to descent of the diaphragm, and the bandage should be sufficiently loose to allow for this increase; a bandage that is loose immediately after birth, may often after a few hours cause injurious compression; it will be the duty of the obstetrician to see that no mistake is made in this matter. The fewer pins used in fastening the clothing of the infant the better, and as far as possible tapes should replace them.

Apparent Death in the New-Born.—The infant may be born apparently dead; it utters no cry, makes no movements, there is no pulsation, or only a feeble pulsation in the umbilical cord, and it may be impossible either by the ear or by the finger to detect any beating of the heart. Yet the child may not be really, only apparently dead,

and its life is in the hand of the physician. Two forms of asphyxia may occur in the new-born, which from the appearance presented by the latter have been distinguished as pale and livid; the former has been termed an anæmic, and the latter an apoplectic condition. The first, which is the more serious form, is characterized by general pallor of the skin, the child is "pale as baby carved in stone," but it is far from having anything like the rigidity of stone; the lower jaw drops, and the mouth is open; the limbs are relaxed and limp, and the body is without firmness, taking such shape as may be impressed upon it by external causes. In the second the child's skin is a dusky red, sometimes purplish, the color being most marked upon the face and the upper part of the trunk; the lips are swelled and dark; the limbs are not flaccid, but may be even somewhat rigid; the body as to its external portion seems to have an excess of blood; contrary to that which is observed in the first case, the cord is large and its vessels are full of blood.

The causes of the first form of asphyxia have been divided by Depaul into general or constitutional, and accidental. Among the first is premature birth, or a want of sufficient nourishment from disease of the placenta, for there are changes in this organ which produce a sort of progressive inanition which does not kill, but the child is born thin, emaciated and feeble. Among accidental causes are compression of the cord, or rupture, tearing of the placenta, or its premature detachment. The principal conditions which produce livid asphyxia are prolongation of labor after rupture of the membranes, and uterine contractions more or less continuous in character, such as result from the untimely administration of ergot. Depaul regarded obstruction of the respiratory passages as a cause of each form of asphyxia; such obstruction is the result of efforts at inspiration where the life of the infant is endangered during labor, for then there are introduced, with a variable quantity of air, according as more or less has entered the uterus, into the trachea and bronchi blood, mucus, and amniotic fluid usually mixed with meconium.

Treatment.—In pale asphyxia the infant needs all the blood it can get, at least none must be taken from it; possibly uterine pressure may add some, though thoracic aspiration invites none; for securing more blood, Depaul advised forcing it from the accessible portion of the cord towards the umbilicus. But without any great delay the cord should be tied, then the child plunged into a hot bath, and a little cold water poured from a height upon the epigastrium. Next the surface is quickly dried with warm flannels, and friction made over the chest and along the spine, and the soles of the feet rubbed; if contraction of the toes is made in response to the irritation of the feet, there is hope that resuscitation will be effected. Irritation of the fauces with a feather is sometimes successful in exciting respiration. But these means failing, and not more than ten minutes should be given to their trial, artificial respiration must be tried. As the methods are the same in the two forms of asphyxia, it will be better before describing them to state the special treatment required in the livid or apoplectic variety before resorting to it. The cord is to be

divided, and two or three teaspoonfuls of blood allowed to flow before it is tied,[1] this treatment is rejected by Champneys, but it is endorsed by some of the best obstetric authorities, and in some cases is followed by prompt improvement in the child's condition, its livid hue lessening, and efforts at respiration occurring almost immediately after the loss of blood. Any collection of mucus or other matter in the fauces or air-passages, both in this and in pale asphyxia, should be removed. This can be done in the former by the finger covered with soft linen, the child being placed upon its back, and the head raised. Depaul was in the habit of using his laryngeal tube, aspiring with his mouth fluids which might be in the trachea. Champneys advises the following plan:—

If there is great accumulation of mucus in the air-passages, a No. 9 gumelastic male catheter should be introduced into the trachea, so that the point is three and a half inches from the lips. This length will secure its passing through the glottis, but not as far as the bifurcation of the trachea. Press the thorax gently with one hand to prevent the entrance of air, and blow through the catheter. The opening being low down in the trachea, the air and mucus with it being unable to pass into the lungs on account of its compression by the hand, will rush up through the glottis, and the mucus will be blown into the pharynx. This can be repeated as often as necessary, the general tendency of fluids in the air-tubes being to ascend during respiration, whether natural or artificial, towards the mouth. This manœuvre is more efficient and far pleasanter than the suction usually recommended; it has answered well in practice.[2]

Different Methods of Performing Artificial Respiration. 1. *Sylvester's Method.*—Charpentier states that he has several times succeeded in resuscitating still-born infants in the following way: The infant is lying upon the back, wrapped in warm cloths, the head resting on a pillow, and the arms placed upon the sides of the chest. Then raise the arms, bringing them quickly towards the child's head, after which replace them at the sides of the chest. These movements, several times alternately repeated, dilate the chest and thus facilitate the entrance of air. Although not so designated by Charpentier, it is really that which is known as the method of Sylvester.

2. *Mouth to Mouth Insufflation.*[3]—Here, after wiping the mouth of the infant, the obstetrician, first taking a fresh and large inspiration, applies his mouth to that of the child lying upon the back, and expiration is made with some force. It is not necessary to close the infant's nostrils, for these, as Champneys suggests, act as a safety valve, and besides air escaping through them may drive out obstructing mucus; it is useless to press upon the cricoid cartilage, according to the same authority, with the hope of preventing air passing into the child's

[1] Respiration in Still-birth, American Journal of the Medical Sciences, April, 1886.

[2] Op. cit.

[3] In the Holy Bible, Second Book of Kings, fourth chapter, thirty-fourth and thirty-fifth verses, we have an instance of resuscitation from apparent death, or restoration from actual death by the prophet Elisha, in which the method seems chiefly to have been mouth-to-mouth insufflation.

stomach. The escape of air is secured by pressure upon the child's chest and over the stomach, for some inevitably enters the latter organ.

3. *Insufflation through a Tube passed into the Larynx.*—The French are very partial to this method; Depaul's tube, a modification of Chaussier's, is preferred by most. Depaul, who had devoted much study to the subject, advised ten or fifteen insufflations a minute; the escape of air after each insufflation resulting from the elasticity of the lungs, and this spontaneous expiration being rendered more complete by suitable pressure with the hand or hands applied to the chest; thus the play of respiration is aided, and there is produced upon the muscles of the chest and upon the diaphragm an advantageous excitement. He observes in regard to the time that insufflations are continued, that it varies with the case. "Two or three have been sufficient in some; in other circumstances it was necessary to continue them for ten minutes, a half an hour, an hour, or even two hours."

4. *Schultze's Method.*—The operator stands with his lower limbs somewhat widely apart, and his body slightly inclined forward, the arms and forearms extended. The infant is now held, its anterior plane in front, by the index finger of each hand entering the axillæ from behind, the thumbs supporting the face laterally, and their ends resting upon the upper and anterior part of the thorax. This is the position of inspiration. After a moment the operator very quickly raises his arms until they pass the horizontal line and become oblique with reference to his body, and the child is made to revolve upon the index fingers as an axis, so that its head is now lowest, and its hips highest, its lower limbs falling upon the anterior aspect of the body which is directly before the operator's face; the child's weight in this position rests upon the thumbs of the operator, which are placed upon the anterior face of the thorax. If this movement of partial revolution be made too rapidly, the child's back is bent too much in the dorsal vertebræ, whereas it is designed the bending shall occur in the lumbar vertebræ. While the head is in this dependent position the movement of expiration occurs, and any fluids that may have entered the air-passages flow out. The operator now lowers his arms, swinging the child back into the first position, when all pressure of the thumbs upon the chest is relaxed so that they may give no impediment to inspiration. These movements are repeated at suitable intervals.

Management after Resuscitation.—Bell makes the statement that out of ten infants resuscitated after having been still-born, when the work of resuscitation has lasted three-fourths of an hour or over, at least six of them will die within two or three days unless relieved by prompt measures. He advises, if the child be sleepless and suffering pain, the potassic bromide with tincture of hyoscyamus or chloral. "The early and frequent use of the warm bath is a most potent means of restoring vascular equilibrium, while the hot flaxseed poultice removes active congestion and assists in ultimately bringing about the same result. When the chest or abdomen is the seat of injury the poultice is indispensable. Nourishment should early be supplied to the child, and a desire for it is a most favorable result. Whenever the pupil is contracted and the eye bright the iodide or bromide of potassium along with chloral may be given with confidence, and

opium as a rule is contraindicated. On the other hand, when both pupils are large and the eyes have a vacant stare, opium will most probably exert a kindly influence."[1]

Attentions to the Mother.—Immediately after the birth of the child the mother is placed upon her back, if she was delivered lying upon her side, with but a single pillow, or only the bolster under her head. From the time of the birth the hand of the assistant, which was placed upon the uterus, following it down during the expulsion of the child, is kept there until replaced by that of the obstetrician. It must be borne in mind that the hand is applied, not flat, but with the fingers and thumb so flexed that a concave surface is formed corresponding with the convexity of the uterus, and that the purpose of this normal application is to assist uniform uterine retraction, thus securing early delivery of the placenta, and guarding against hemorrhage. It is the custom of some practitioners to administer from a half to a teaspoonful of fluid extract of ergot immediately after the birth of the child, while others defer it until after the delivery of the placenta, and still others omit its use altogether in physiological conditions. Ergot given after the removal of the placenta probably cannot interfere in any way with normal processes; it certainly is one of the most important means in the prophylaxis of post-partum hemorrhage, and there is reason to believe that it assists uterine involution. It may therefore be given at the time mentioned in every case, unless there be very active uterine contraction and great retraction, but a dose of twenty or thirty drops will, as a rule, be quite sufficient.

Placental Expulsion.—The delivery of the placenta is one of the most important of the accoucheur's duties. The patient is anxious until this final act in the drama ends; she cannot have the soiled clothes removed from her person and from the bed, nor parts that have been bruised bathed, nor secure that repose which her exhausted condition needs; a delay is sometimes the source of fear to her at least, according to the popular expression, that "the after-birth has grown fast to her side." Therefore it is unwise, as far as her immediate comfort is concerned, to do as practitioners in ancient times did, leave the delivery of the placenta to nature, pursuing a merely expectant treatment. The time of the practitioner also gives an argument against expectation. He cannot wait hours at the bedside, as would be necessary in some cases for nature to expel the placenta, when a little manipulation on his part, simply assisting nature, will accomplish this delivery in a few minutes. The following table of 100 cases in which the delivery of the placenta was left to nature is given by Kabierske.[2]

24 times	30 minutes.	5 times	5 hours.
20 "	1 hour.	3 "	6 "
25 "	2 hours.	2 "	8 "
11 "	3 "	1 time	12 "
9 "	4 "		

These figures are conclusive against trusting to purely spontaneous delivery of the placenta. The method more or less closely followed

[1] American Practitioner, 1882.

[2] Centralblatt für Gynäkol., 1881.

by most obstetricians is known as that of Credé, and briefly stated is this: Frictions, at first gentle and then more or less vigorous, of the fundus and of the body of the uterus are made through the abdominal wall. When a uterine contraction occurs, the obstetrician applies his hand to the organ, the palm upon the fundus, the four fingers upon the posterior, and the thumb upon the anterior wall, and exerts a moderate pressure, which is soon followed by the expulsion of the placenta—it is thus *expressed*, squeezed out "as the seed from a ripe cherry compressed between the thumb and fingers." It is necessary in some cases to repeat this manipulation once or oftener before successful. Credé's method has not escaped criticism. Riol[1] justly states that if practised with too much rapidity and energy, and immediately after the delivery of the fœtus, it may cause tearing the membranes. Certainly retention of fragments of undetached membranes may result from too great haste in the delivery of the placenta. It would be better in physiological cases not to hurry uterine action by friction, but simply to keep the hand applied to the uterus, as first directed, acting in the beginning as a sentinel to warn of danger and advise of condition, and then as an ally of uterine contractions, when they normally occur, a reinforcement to uterine power, not usurping its place, but simply assisting it. Delivery of the placenta by expression is certainly preferable to delivery by traction; it is nature's way to have the delivery occur by a *vis a tergo*, not by a *vis a fronte*, and untimely pulling upon the cord may cause inversion of the uterus, or serious hemorrhage. But granting all this, haste and great force in expression are an evil; nature should be the guide, give the signal for action, and art be the follower and servant.

Pajot advises, after taking hold of the cord, at first to exercise a prolonged tension during some minutes, and subsequently moderate tractions in the pelvic axis. Ribemont-Dessaignes[2] claims that this tension is as rational in principle as it is fortunate in results. Pajot's method, instead of seeking to increase the size of the uterine orifice, seeks to reduce the volume of the placenta; and this reduction, favored by the special structure of the organ, is easily obtained if the latter is permitted to mould itself little by little to the passage it must traverse, in a word to accommodate itself.

It is generally advised that in removing the placenta from the vagina, the former should be rotated so as to twist the membranes into a rope, as it is supposed there is then less danger of their tearing, and fragments being left behind. Such an accident is not likely to happen if they have been completely detached from the uterus, and the manœuvre is hardly necessary, simple, gradual withdrawal being sufficient. When removed, the placenta and membranes are put in a vessel brought by the nurse, which should be turned upon its side, and put with its rim as near the vulva as possible, so that they can be slid in rather than lifted, thus avoiding, as far as possible, soiling the clothes or the person of the patient. After this the obstetrician removes clots that

[1] Etude Critique et Clinique de la Délivrance par Expression.
[2] De la Délivrance par Traction et par Expression. Paris, 1883.

may be in the bed, and puts them into the vessel, when it is taken away, but kept unemptied until he has an opportunity to examine the uterine surface of the placenta, and be sure that no fragments have been left in the uterine cavity. Before removing the hand which has been applied to the uterus through the abdominal wall, the size, position, and firmness of the uterine globe should be found to be normal.

Application of the Bandage.—After the removal of soiled clothes the abdominal bandage may be applied. The value of this has often been disputed, nevertheless most patients think themselves more comfortable with it, and desire it to be used; indeed, some are not satisfied unless their professional attendant applies it. Confirmation of the value of the abdominal bandage has recently been given by Prochownick.[1] It should be worn not merely while lying in bed, but for some time after beginning to sit up. Usually a bandage made for the occasion is at hand; but if not, a bolster cover, as suggested by Leishman, or, better than it, a moderately coarse, crash towel may be used. The bandage is rolled one half its length, and the roll carried under the patient's back to the opposite side, when it is unrolled, drawn so as to be smooth, and arranged to extend from the chest somewhat over the hips. It is then pinned as tightly as is comfortable, the pinning being begun, as taught by Warrington,[2] above, though of course this is not very material. To prevent the bandage from slipping a layer of cotton wadding may be placed upon the abdomen, if the weather be not so warm that this addition will cause discomfort. Some place a pad, formed of one or more folded napkins, upon the abdomen before the bandage is fastened, for the purpose of producing compression of the uterus; if small, it does neither good nor harm, but if thick it may press the uterus out of place. A better plan of securing uterine compression, should this be thought necessary, is the following: Make three firm rolls rather thicker than the wrist, of as many towels; then place one of them transversely just above the uterus, and the other two at its sides, and let the bandage be pinned firmly over them; thus the uterus is as it were included in a box, the lid of the box being the portion of the bandage in front of the abdomen.

The nurse uses a warm vaginal injection of a three per cent. solution of carbolic acid, or 1 to 3000 of corrosive sublimate, and cleanses the external sexual organs and adjacent parts with a similar antiseptic wash.

If there be the slightest suspicion of any injury to vulva or perineum it is the duty of the obstetrician to make a careful inspection of the parts. As a rule, if there be any serious tear of the perineum, sutures must be at once introduced. Slight tears there or elsewhere may be covered with an antiseptic powder as of iodoform. Then a warm napkin, which should be sprinkled with an antiseptic solution, if there be danger of septicæmia, is applied to the vulva, the chemise and night dress drawn down, and the patient prepared for that rest which her exhausted state so much needs.

[1] Op. cit.

[2] Obstetric Catechism.

The practitioner remains with the patient for an hour after the labor has ended, and then, if she be comparatively free from suffering, the uterus well contracted, and the pulse and flow normal, he need not hesitate to leave.

The woman is now, in the strict sense of the term, a *puerpera*, and the puerperal state has succeeded that of labor. The phenomena and management of puerperality will be studied hereafter.

CHAPTER IV.

THE CONDUCT OF LABOR (*Continued*)—OCCIPITO-POSTERIOR POSITIONS—FACE, BROW, AND PELVIC PRESENTATIONS—TWINS.

The Management of Occipito-Posterior Positions.—As has been stated in almost all cases of right or of left occipito-posterior positions, the occiput rotates in front, and the head is delivered as in an original occipito-anterior position. The labor is longer and the suffering greater. In exceptional cases, when by perversion of rotation the occiput turns into the sacral cavity, the delivery of the head causes increased danger to the perineum.

The delay in anterior and the possibility of posterior rotation have led many obstetricians to urge the importance of manual, or even of instrumental, means to effect or assist the former. Smellie was among the first to claim that such rotation could be effected by the hand or by an instrument. He states, referring to the former means, that "turning the forehead into the hollow of the sacrum might be assisted by introducing some fingers or the whole hand into the vagina during a pain, and moving it to the right position." Portal and Leroux advised pressing with the hand upon the abdominal wall so as to withdraw the face from the anterior pelvic wall. Velpeau taught that when the head had descended into the pelvic cavity, almost immediately after the escape of the waters, two or three fingers should be placed just before the sacrum, in order to push the occiput in front, or behind the pubes, upon the side of the forehead, in order to press the latter backward. Meigs, referring to delay in labor from failure of anterior rotation, directed that two fingers should be placed upon the child's head, just behind the ledge formed by one of the parietal bones overriding the occipital, and then drawing the vertex down, thus increasing flexion; he added, "If such gentle measures will not succeed we have the powerful resource of half the hand, which may be introduced into the vagina, and sometimes within the cervix, and which, taking the head in its palm and fingers, can place the vertex wherever it may be desirable to fix it." Hodge's view was that anterior rotation could generally be caused by pressing on the temple during a "pain" and also in the interval; the pressure should be made upon the left temple in right occipito-posterior, upon the right temple in left occipito-posterior position. Mattei believed that he had often succeeded in effecting anterior rotation of the occiput by acting upon each pole of the fœtal ovoid, the fingers of the right hand being used to draw the occiput in front, while the left hand was applied to the fundus of the uterus to cause a corresponding rotation of the trunk. Tarnier advises this plan: When the os is nearly or quite dilated introduce the

index finger—the left one in right occipito-posterior position—and apply it to the cranial surface immediately behind the left ear of the fœtus, thus securing a good purchase; at the beginning of a uterine contraction the finger is pressed firmly, but without violence, at the same time bringing the head toward the pubes, then to the joint, and finally to the opposite side, so that the occiput is directly in front. The first attempt often succeeds, but if, after being repeated two or three times, there is still failure, it is better to desist.

Angus MacDonald[1] held that in all persistent occipito-posterior positions we may safely assume we have some pelvic peculiarity or disproportionately large head to deal with, and, as a rule, all attempts at rectification of the position of the head will prove abortive, and are even dangerous if attempted by means of levers, forceps, etc. Not dissimilar was the teaching of Cazeaux; he regarded all manœuvres to effect anterior rotation as quite useless. So, too, Charpentier looks upon manual efforts as in vain, and when they appear to succeed, the rotation would occur without them.

When we consider the prolongation of the labor in a permanent occipito-posterior position, and the greater suffering of the mother and peril to the child, and the necessity oftentimes, especially in primiparæ, of using the forceps, the final results probably being a dead child and a torn perineum, it certainly seems as if an effort ought to be made to effect anterior rotation by the hand, unless the position has become occipito-sacral for then intervention is vain. The essential reason for the failure of anterior rotation is that the occiput meets with too great, and the forehead with too little, resistance. We cannot lessen the former, except indirectly, but we can increase the latter. Direct pressure upon the forehead then seems the most rational means for making way for the descent and anterior rotation of the occiput; all manœuvres to push or pull the occiput forward and to push the forehead back by the fingers on the temple probably are vain —they seem to mistake nature, and they do not invite the normal mechanism of labor. It may be said that this proposed resistance given to the descent of the forehead is simply increasing flexion. Very well, and why does flexion occur in any stage except to facilitate the descent of the occipital end of the occipito-mental diameter? Resist the descent of the forehead, letting the occiput alone, is the simplest, safest, surest, manual means of effecting anterior rotation.

The Management of Face Presentations.—The older obstetricians advocated in presentations of the face either changing it into that of the vertex, or podalic version. Louise Bourgeois, 1710, remarked that when the chin advanced first in the passage delivery was impossible, and the hand must be introduced to push back the chin upon the chest. Baudelocque advised the same method, and if it failed only podalic version or instrumental delivery remained. Smellie said that when the "face presents resting upon part of the pelvis, the head ought to be pushed up to the fundus of the uterus, the child turned and brought by the feet." He admitted, however, that in some instances sponta-

[1] Transactions of the Edinburgh Obstetrical Society, vol. iii.

neous delivery occurred. Paul Portal, 1685, nearly a century before Smellie made the statement I have quoted, was contented with "anointing the woman's parts with butter in order to soften and relax them, thus making the escape of the infant easier;" he stated that the accoucheur should be careful not to produce any irritation with his finger, otherwise he will cause a thousand times more injury to the mother and to the child than the accouchement, which has no more mystery than a natural labor. It was not, however, until Lachapelle asserted that these labors terminated as easily as those with vertex presentation, that the profession generally abandoned interference, leaving the delivery to nature. Nevertheless the affirmation of the perfect safety of labor in presentation of the face is somewhat an exaggeration, and the profession is not unanimous in regard to the uselessness of intervening. Hodge held that when the practitioner was called early, and recognizing a face presentation, he should, after the os is dilated, and before the presenting part has passed this opening, substitute the vertex, for under these circumstances, especially in multiparous women, the operation can be easily and rapidly performed without much suffering to the mother. Recently Partridge has advocated this plan of treatment. He states the conditions favorable to it, and the method as follows: "An os nearly or quite dilated; a face not engaged in or at least capable of being lifted from the pelvic brim; an unruptured bag of waters; a capacious vagina. In the majority of labors a stage is reached when these conditions are present. Chloroform to relax the structures of the parturient canal, to quiet the movements of the patient, and to obviate pain caused by the introduction of the hand into the vagina, is of primary importance. The manipulation requires the presence of the fingers only in the uterus, and does not involve any laceration of the cervix. Passing the palms of the fingers over the occipital bone, and pressing them firmly against it, traction downward should be made. In our endeavors flexion of the head almost immediately commenced and quickly became complete. The other hand aided greatly by external manipulation."[1]

Schatz advocates conversion of a face into a vertex presentation by external manipulation. He directs that this should be undertaken chiefly in the first stage of labor, exceptionally, perhaps, also during pregnancy. The following description of the mode of operating is given by Mundé in his valuable work.[2]

In the interval between the pains, the operator seizes the shoulder and the breast of the child with one hand, and pushes both upward and to the side where the back lies; *i. e.*, the same side towards which the brow points; as soon as breast and shoulder have been brought into the long axis of the fœtus the pressure is directed towards the back of the child, at the same time the other hand firmly grasps the fundus of the uterus with the breech, and pushes it to the side towards which the thorax points; care must be taken not to antagonize the direction of the first hand, but rather to press perpendicularly towards it; and later, when the shoulder is in the long fœtal axis,

[1] American Journal of Obstetrics, 1884.

[2] Obstetric Palpation.

parallel to it, but in the opposite direction. Then the pressure of the second should be directed laterally and downwards, or directly downwards, in order to remove the thorax and shoulder as far as possible from the long fœtal axis to the side where the back lies.

Mundé gives as the great advantage of this method that it can be undertaken before the rupture of the membranes while the face is still at the brim; and that, if it fails, it has at all events done no damage. He also states that success has attended it in the hands of Schatz, Fritsch, and Welponer.

Pippingsköld's method of changing a face into a vertex presentation is by combined internal and external manipulation. Pressure is made with the fingers of one hand in the vagina pressing first upon the chin, then upon the superior maxillary, and finally upon the orbits so as to promote flexion; the other hand presses externally upon the occiput in order to assist this movement. Of course this plan cannot be executed unless the occiput can be readily felt by the external hand. Schatz's method is only applicable to primitive face presentations recognized before labor; it is not practicable if the fœtus is large and the abdominal wall is thick, tense, or very sensitive.

The performance of podalic version in presentation of the face is not practised by obstetricians of the present day. Indeed the attempt to substitute the vertex for the face is seldom tried, though Partridge's success is encouraging. This attempt, as remarked by Galabin, may only partially succeed, as is very probable, and then the head is brought into the more unfavorable position of brow presentation. He further states that the statistics of the Guy's Lying-in Charity show that more than 99 per cent. of the cases terminated favorably, and therefore interference is generally quite unnecessary. The late Dr. Albert H. Smith[1] held that in most cases of face presentation, even with the chin posterior, nature is best able to terminate the case satisfactorily. "It is to this class that the aphorism 'meddlesome midwifery is bad' is most applicable."

Supposing no effort to have been made to substitute the vertex for the face, or the effort has failed, an essential part of the mechanism of labor is anterior rotation of the chin. Efforts to promote this are advised by some, and they certainly are important in case of great delay.

When the face is in the pelvic cavity it has been advised to at once endeavor to secure anterior rotation of the chin; others advise waiting, Chantreuil, for example, directed a delay of three hours before intervention. This is made by pressing with a finger upon the side of the head so as to determine turning the forehead to the sacral cavity, or hooking a finger over the chin so that it may be drawn toward the pubic arch. Failing in this the forceps may be necessary, and for this use the straight is better than the curved instrument. Dr. Penrose[2] advises in delayed rotation pressing with the forceps blade, or with the hand upon the posterior cheek.

[1] American Journal of Obstetrics, vol. xvi. p. 1195.
[2] American Supplement to Obstetric Journal, 1876.

Dr. Parry[1] has recorded a case where having failed in attempts to flex the head, or to rotate the chin anteriorly, or to extract with the forceps, and craniotomy seemed the only alternative, he succeeded by his hand introduced into the pelvic cavity in pushing the head above the inlet, and then converting the presentation into that of the vertex; such success when labor is thus far advanced must be altogether exceptional.

The best way of promoting anterior rotation of the chin, should intervention be necessary, is to resist the descent of that part of the face which is opposite, that is, the forehead. It is the same method as was advised to secure anterior rotation of the occiput when it was posterior. In this case it may be said that the proposed resistance causes perfect extension, as in the former perfect flexion. But beside that it pushes back, hinders, and resists the descent of that part which ought to rotate in the sacral cavity, and opens the way for the rotation in an opposite direction, and the descent of the part which is opposite; when forces are applied to a mobile body, such as the head of a child is, whether the cranial or facial portion is presented, rotation occurs in the direction of least resistance. Rotation is here, as always in the mechanism of labor, simply one of the important phenomena of accommodation.

In the management of face presentations great care must be taken that digital examination be made with the necessary care and gentleness lest injury be done, especially to one of the eyes. It is better to frankly tell the patient that the labor will be protracted, but at the same time she may be assured that it is almost certain to have a fortunate issue both for herself and for her child. Friends who are with her should be informed of the probably very great disfigurement of the child's face, the statement being also made that this is sure to disappear in a few days. Great danger comes to the child in the disengagement of the head, for during this the throat is pressed against the pubic arch, and if delay occurs it may be necessary to actively assist the delivery.

Management of Brow Presentations.—As extension of the head gives presentation of the face, so partial extension results in presentation of the forehead or brow. Upon digital examination the apex of the forehead is found to be the lowest part of the head, the suture between the two halves of the frontal bone can readily be traced to the anterior fontanelle, and in the opposite direction the different parts of the face are found. Now it is almost certain that the presentation of the forehead will be only temporary; for either flexion occurs, and the vertex presents, or, and this is the more frequent, extension becomes complete, and the final presentation is the face. Charpentier makes the positive statement that if one has the wisdom to wait, he will always see the presentation changed into that of the vertex or of the face. If the head be small spontaneous delivery is possible without change of presentation. Kleinwächter takes the ground that when the head is in the pelvic cavity, an attempt to substitute the vertex or the face is not to be made, for even if successful the head which has already been

[1] American Journal of Obstetrics, 1875.

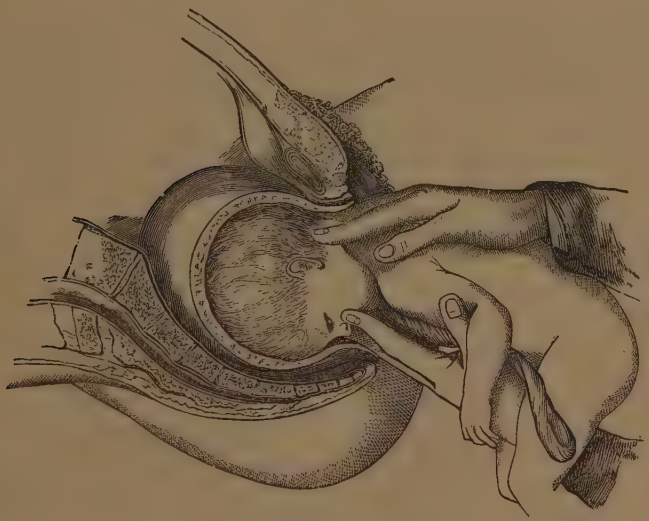
more or less moulded into the form necessary for delivery, must undergo a new configuration for delivery with a new presentation, and thus time is lost to the danger of both mother and child. Hodge taught that a brow presentation should be converted into that of the vertex as soon as the os uteri is sufficiently dilated for the passage of the hand of the practitioner. Even when the head has passed the os he thought this could be done in many cases. Possibly his advocacy of an early active interference arose from the fact that he did not recognize the almost unexceptionally spontaneous change of presentation, for he cautiously observes, "perhaps in the majority of cases" this change occurs. Hildebrandt directs that in persisting brow presentation the woman should be placed upon her side across the bed, and the practitioner then apply two fingers of the right hand, at the beginning of a uterine contraction, upon the forehead and exert a pressure directed toward the occiput if a facial presentation is desired, or toward the face if descent of the occiput is preferred. Long advises the same method, but urges the importance of conversion into a vertex presentation. He adds: "If this is unsuccessful the whole hand should be introduced into the vagina, and the fingers passed up over the occiput, pushing the head up first if necessary, and then drawing downward upon the occiput, and with the thumb pushing up the brow as well as possible, so that the head should be completely flexed. Assistance can sometimes be had by external manipulation with the other hand, and sometimes by having the woman in the knee-chest position. Anæsthesia should always be induced in order to relax the parts and render the manipulation painless."[1] It is probable that in most cases when the attendant believes he has substituted the face or vertex for the forehead, the change would have occurred without his interference. Knowing the almost invariable change of the presentation which occurs spontaneously, it is better for the practitioner to wait a reasonable time for nature's action, unless the condition of the mother or child demands immediate intervention.

The Management of Pelvic Presentations.—The practitioner should guard against an early rupture of the membranes, and even though the first stage of labor is protracted it might be well to have the woman lying down most of the time. No effort should be made to hasten delivery during the expulsion of the lower half of the body; no traction upon the trunk is to be made, for it may cause not only departure of the chin from the chest, but also of the arms to the sides of the head or even behind it. If the patient be anæsthetized, great care must be taken that the anæsthesia is not to such a degree as to lessen either voluntary or involuntary expulsive power when that power is most needed in the expulsion of the upper part of the trunk and of the head. One hand protects the perineum during the expulsion of the breech which is received by the other. As soon as so much of the body is born that the umbilical cord comes within reach, a loop should be drawn down to guard against stretching and pressure, and also to know by the pulsation the condition of the child; if the

[1] American Journal of Obstetrics, 1885.

cord be around one of the limbs it should be removed from this position; next, it should be placed in such position that it will be least liable to pressure; that is, where there is the most room for it, and this will generally be upon one or the other side of the sacral promontory. If the arms have departed from the chest, an accident which is not likely to occur unless traction has been made upon the trunk, they are to be brought down, usually the sacral arm first, by passing one or two fingers up to the shoulder, and along the inner side of the humerus, if this be possible, to the bend of the elbow, and then by gentle pressure drawing the forearm over the breast, causing the dislocated member to be returned by a movement the reverse of that which displaced it. But if it is impossible to reach the elbow, the finger or fingers must be passed over the acromion, and pressure made directly upon the upper part of the humerus, and gradually carried further toward the elbow, until both are drawn down. Rotation of the face into the sacral cavity next occurs, the shoulders now being transverse with reference to the vulvar orifice; it may be assisted by making external rotation of the shoulders. Continued flexion of the head is secured by assisting uterine contraction with manual abdominal pressure, by—according to most, though the practice is rejected by Barnes as meddlesome midwifery—pressing two fingers upon the superior maxillary, or by digital pressure anteriorly upon the

FIG. 144.



ARTIFICIAL DELIVERY OF THE HEAD IN PELVIC PRESENTATION.

occiput; or, finally, when the body of the child is carried somewhat upward, supposing the mother to be in the dorsal position, the occiput presses against the pubic joint, and the resistance thus offered compels the chin to descend, which promptly passes out first. During the delivery of the head support of the perineum need not be attempted, its rupture rarely occurs during the passage of the head in pelvic presen-

tations, and, beside, both hands of the accoucheur are otherwise occupied. Delay in expulsion of the head is guarded against by having the patient make active voluntary efforts, by frictions upon the uterus to excite its contractions, and by supra-pubic pressure. Some obstetricians advise the forceps if there be delay. Meigs stated that it was an invariable rule to have the forceps in readiness in every instance when the head was to be born last. Depaul was accustomed to give two grams (30 grains) of ergot in three doses, at ten minutes interval, as soon as the pelvis appeared at the vulva.

A serious source of delay in the delivery of the head arises in some cases from contraction of the os uteri around the neck of the child, causing a dangerous compression of the throat. Depaul, who has described the occurrence of this obstacle, advised the use of the fingers, introduced into the os to dilate it, and, if resistance continued, incisions.

In those cases where the occiput rotates posteriorly, the assistance in the delivery depends upon whether the head remains flexed or is extended. It will be remembered that in describing the mechanism of labor in pelvic presentation with posterior rotation of the occiput, we stated that if the head remain flexed the suboccipital region pivots on the anterior margin of the perineum, and the mental end of the head pole passes out first; hence, in this delivery, the patient lying on her side, the practitioner carries with one hand the body of the child with its back towards the mother's back, and endeavors, with one or two fingers of the hand pressed upon the chin, or upon the superior maxillary, to keep up flexion while the head is delivered. In those cases where the head becomes extended, the chin caught, as it were, above the pubic joint, the occipital end of the long diameter of the head must pass out first, while delivery is effected by flexion, the anterior portions of the throat pivoting upon the margin of the pubic joint. Hence the practitioner raises the body of the child nearly vertically, its abdomen directed towards the mother's abdomen.

Doubled Fœtus.—Delay in the delivery of the pelvis in the usual form of pelvic presentations may require, in the interest of the mother or of the child, manual assistance, and there is usually no difficulty in bringing down one foot, or both feet, so that traction can then be readily exerted. There is, however, an unusual form of presentation in which not only are the thighs flexed upon the abdomen, but the legs extended upon the chest, the fœtus being doubled. The lower limbs in this position act as a splint to the body, and make it rigid and inflexible. The diagnosis of presentation by abdominal palpation presents a peculiar difficulty from the vicinity of the feet to the head, for, as a rule, when a solid, round body is felt with small mobile bodies near it, the conclusion justly drawn is that the body is the hips, so that in a case of this variety of pelvic presentation the error of believing that the head is in the lower part of the uterine ovoid can be very readily committed. These cases are the most unfavorable variety of pelvic presentation, and, as a rule, assistance is necessary. Various methods are advised.

1. Traction by a finger hooked over the groin; the force which can be thus exerted is trifling.

2. Decompose the wedge by bringing down a foot. Barnes[1] advises this method, stating that he has on several occasions brought a live child into the world where forceps, hooks, and various other means had been tried in vain for many hours, by passing his hand into the uterus and bringing down a foot. His directions are as follows: "Place the patient on her left side; produce anæsthesia to the surgical degree; support the fundus of the uterus with your right hand on the abdomen; pass your left hand into the uterus, insinuating it gently past the breech at the brim, the palm being directed towards the child's abdomen, until you reach a foot—the anterior foot is the better to take; a finger is then hooked over the instep, and drawn down so as to flex the leg upon the thigh. Maintaining your hold upon the foot, you then draw it down out of the uterus, and thus break up the wedge."

Playfair regards the procedure as always difficult, and it may be very hazardous.

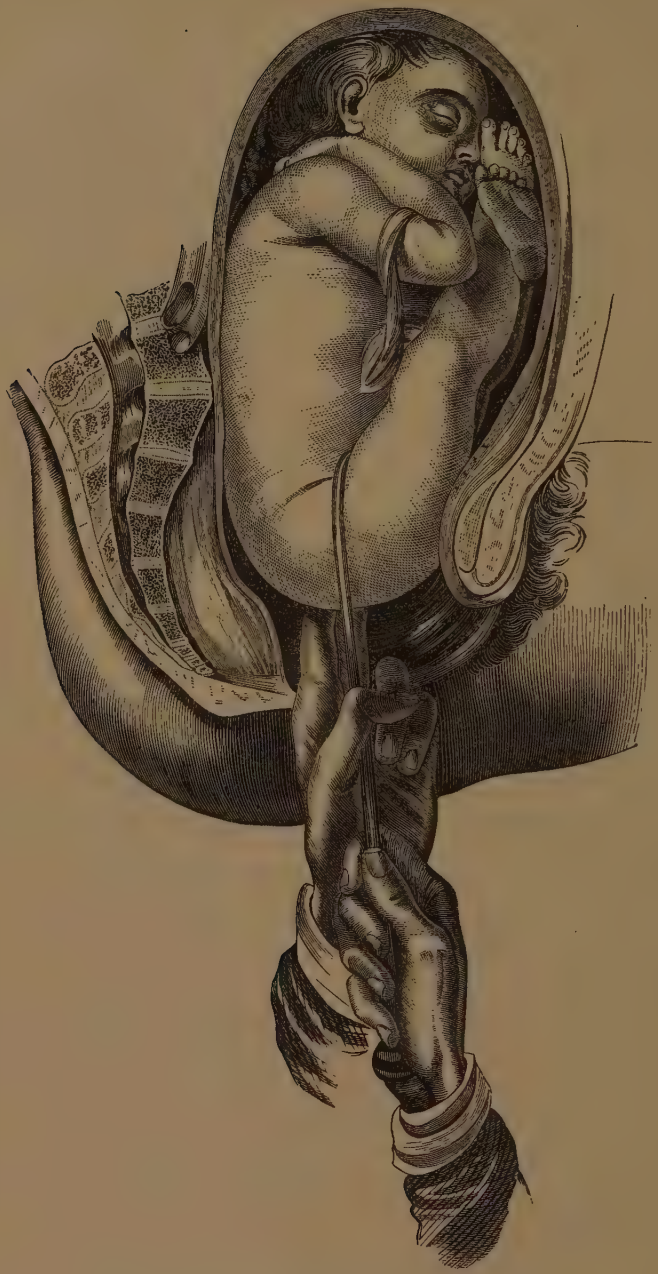
3. Traction by a fillet. Playfair[2] advises placing a fillet over the groins; this method was used by Giffard. As a fillet Playfair suggests a silk handkerchief or a skein of worsted; he applies it by means of a stout piece of copper wire bent double in the form of a hook, the extremity is guided over the hips, and through its looped end the fillet is passed; the wire is now withdrawn, and carries the fillet over the groins.

Galabin[3] directs passing the fillet round the child's pelvis in the following way: A soft, oiled handkerchief may be used for the fillet; a knot is tied in it at two opposite corners. By means of the fore-finger the corner is to be passed from without inward over the flexure of the groin till the knot can be reached between the thighs and drawn down. In the same way the opposite end of the fillet is to be passed from within outward over the other thigh. The centre of the fillet is then slipped up over the buttocks till it surrounds the sacrum, and traction is made by the ends. In this way the pressure is distributed over both groins and the circumference of the pelvis. If the fillet is passed over one or both thighs only, care must be taken, if the abdomen looks forward, that it does not slip up from the groin to the thigh, and so cause fracture of the femur. In place of the handkerchief a moderately broad strip of oiled lint may be used. A still better fillet may be made of a piece of thick-walled India-rubber tubing about the size of the little finger. A strong piece of tape is passed through the tube and sewn to each end, the ends of the tape projecting beyond it. The knotted ends of the tape are then passed over the flexures of the groins from without inward as before. If the fillet cannot be passed over the thigh by the index finger, a large gum-elastic catheter, with stylet, may be bent to a suitable shape resembling that of the blunt hook, and passed from without inward over the thigh, having a tape attached to its extremity. By means of the tape the fillet can be drawn into position.

Charpentier objects to the fillet on the ground that it may cause

[1] Obstetric Operations. [2] Op. cit. [3] Op. cit.

FIG. 145.



BREECH PRESENTATION.—Application of the blunt hook.

fracture of the thigh; but applied as Galabin directs this result seems very improbable.

4. The blunt hook may be used. This is introduced between the thighs, and its point turned toward the mother's pelvis. It is generally applied over the pubic, not over the sacral thigh. Charpentier states that in two cases in which he has seen it used by experienced obstetricians injury was done; in one the femur was broken, and in the other the abdominal wall was torn just above the groin.

5. The forceps may be applied. This will be considered in Obstetric Operations.

6. Guéniot advises traction with the fillet or with the blunt hook upon one groin, and the introduction of a finger into the anus, then curve it so as to secure a point of resistance upon the coccyx or the ischia, and endeavor to draw down the pelvis until the fingers can be introduced into each groin, and traction be made by them.

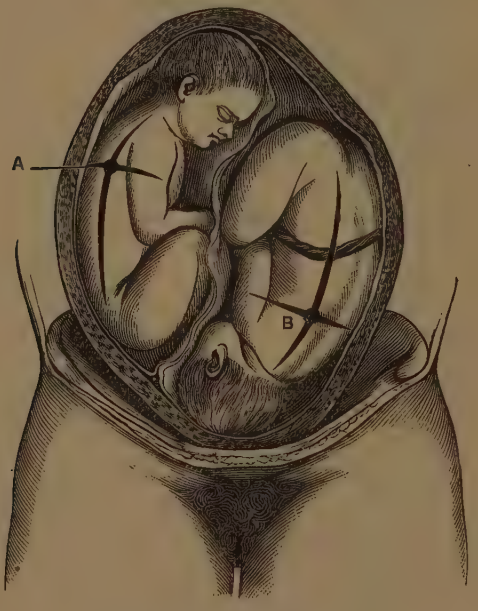
Charpentier remarks that pelvic presentations, while not absolutely grave for the mother, require a somewhat cautious prognosis, for the mortality is 1 per cent., while in vertex presentations it is only 0.57 per cent. The mean fœtal mortality during labor is 35 per cent., and 5 per cent. of infants born living die within twenty-four hours after birth, while only 2 per cent. die in vertex presentations during labor, and 1 per cent. in the following twenty-four hours. Considering, therefore, the difficulties and dangers of pelvic presentations it has been proposed to change them in the latter part of pregnancy by external manipulations into those of the vertex. The grounds upon which objection is made to this treatment are, first, the difficulties in delivery occur more especially in primiparæ in whom such version may be difficult or impossible, while in multiparæ, in whom version may be readily done, the prognosis of pelvic presentations is not serious; second, it is chiefly in those cases where the fœtus is doubled that are the most serious, and in these version is almost if not quite impossible. "The dangers for the mother and for the child belong less perhaps to the presentation itself than to the inexperience and the untimely intervention of the accoucheur."

The Management of Labor in Twin Pregnancies.—Tarnier's statistics show that in more than two thirds of pregnancies with twins labor is premature. The reason for this fact is the very great distension of the uterus. The labor is usually longer in both the first and in the second stage. The causes are the changes in the cervix, belonging to the last period of pregnancy, have not occurred in the majority of cases, and hence increased resistance is to be overcome, the great distension of the uterus lessens its contractile power, and the force distributed over so large a surface is less efficient.

The statistics of Depaul and Tarnier, embracing 316 twin labors, show that in 131 cases each fœtus presented by the vertex; 81 times the vertex of one fœtus and the pelvis of the other presented, and 47 times the pelvis, and then the vertex, while the remaining presentations were of the vertex and of the shoulder, of the pelvis and of the shoulder, vertex and face, face and vertex, etc. Kleinwächter makes vertex presentations 69.58 per cent., pelvic presentations 25.25 per cent., and transverse 5.17 per cent. Most frequently both fœtuses are born with vertex presentation, 49.29 per cent., more seldom one ver-

tex, the other pelvic, 34.49 per cent. Still more seldom does the birth of both occur with pelvic presentation, or of the first with pelvic, and the second with shoulder presentation, or both with the latter, 6.23, 6.11, 3.55, 0.33.

FIG. 146.



FIRST CHILD PRESENTING BY THE VERTEX; SECOND BY THE PELVIS.—*B* and *A*, points of maxima of intensity of sounds of the fœtal heart.

In more than one-half the cases the second child is born within twenty minutes after the first. In one of 212 cases given by Collins the interval was twenty hours, twelve hours and forty minutes in 1 out of 188 cases observed at the Paris Maternity; Reuss gives an instance where the interval was twenty-six hours. When the presentation of the first child is favorable, the rule is no interference is advisable in the first stage of labor; after the os is dilated the membranes may be ruptured, and the labor conducted as usual. After the child is born the practitioner, in most cases, knows for the first time that the pregnancy has been multiple; he finds the uterus firm, nearly as large as it was before the birth of the child, and upon digital examination ascertains that there is a second one within the womb. In all cases a second ligature of the umbilical cord is imperative, for while there probably is no vascular connection between the placentæ, the possibility of its existence requires guarding against destroying the life of the second child by hemorrhage. All traction upon the cord to remove the placenta from the uterus is especially forbidden. If the mother desires to know whether she is to have another child, a knowledge which in many cases is by no means pleasant, let the truth be frankly told; she may

at the same time be assured that the labor will almost certainly be easy and brief, for not only has the birth-passage been fully dilated, but the second child is generally smaller than the first. If the presentation is normal, the sounds of the fœtal heart distinct, and the mother's condition favorable—none of the grave accidents of labor, such as eclampsia or hemorrhage present—it is better to wait until expulsive pains return, and not cause immediate delivery. Supposing that the labor is premature and the child that has been expelled feeble or dead, and the placenta discharged, it is possible, as suggested by Depaul, that the second child may be carried to the full period of gestation, and therefore interference would be forbidden. But when the placenta remains in the uterus there is no ground for this hope, and the practitioner should not leave the patient until she is delivered. As soon as decided pains occur the membranes are to be ruptured, and retraction of the uterus secured by manual abdominal pressure during and for a time after the expulsion of the child; ergot should be given immediately after the delivery of the placenta.

CHAPTER V.

THE PATHOLOGY OF LABOR—ANOMALIES OF UTERINE AND OF ABDOMINAL FORCE—STRUCTURAL AND POSITIONAL UTERINE ANOMALIES—ANOMALIES OF ADJACENT ORGANS.

THE pathology of labor includes anomalies of the forces by which the fœtus and its appendages are expelled, positional and structural anomalies of the uterus, and anomalies of the adjacent organs, anomalies of the fœtus—abnormal size, either from excess of development, or from pathological conditions and new growths, abnormal or complex presentations, and in a pluriparous pregnancy the interference of one fœtus with the expulsion of the other—anomalies of the pelvis, and finally accidents which may occur in connection with labor imperilling the life of the mother or of the child.

I. *Anomalies of the Forces concerned in Labor.*—These anomalies relate chiefly to the uterine force. This force may be abnormal by excess, by deficiency, or by perversion; it may also be abnormal by being attended with unusual suffering.

A. *Excess of Uterine Force.*—In those cases where the uterine contractions are strong and recur rapidly the labor has a speedy[1] end without danger to mother or child, provided the latter present favorably, and the birth-canal offers no serious obstruction, and suitable precautions are taken. But in the absence of proper care delivery may surprise the woman while she is standing, or while she is upon a commode, or in the water-closet, and the child be injured, the cord torn, the uterus inverted, or relaxation follow the violent uterine action, and hemorrhage result. Again, if the os, or the perineum does not yield readily a tear in one or both may occur from excessive uterine action.

Emphysema of the Neck, Face, and Chest.—If voluntary efforts in labor are very great, especially in primiparæ, it sometimes happens that rupture of some of the air vesicles occurs, and emphysema of the neck, face, and chest follows. Blundell[2] has spoken of the condition as follows: "It is not frequently that a disruption of the larger air-tubes occurs in the progress of laborious parturition; yet this accident is sometimes observed, the trachea or bronchi giving way. After much exertion, the neck and face swell; from the hurrying of the circulation, an erythematous flush of the integuments is produced, and at first glance the patient appears to labor under a sudden attack of erysipelas; the nature of the swelling manifesting itself on making an examination by the usual crepitus per-

[1] The old authors described it as *partus præcipitatus*, precipitate birth.
[2] Principles and Practice of Obstetricy.

ceived on compressing, and lightly shampooing the skin with the tips of the fingers. Should emphysema occur, delivery is desirable. To retain the breath and force down is likely to aggravate the disease, so that the emission of the voice may be recommended. After delivery, if I may judge from the single case brought under my notice, the aperture, seldom capacious, heals spontaneously, and without inflammation the air is absorbed."

The swelling and the characteristic crepitation indicate very clearly the nature of the accident; Schroeder states that the emphysema, if not very great, disappears spontaneously in five or six days. Of course the patient is not permitted to continue any voluntary effort, but the labor must be terminated by the sole force of uterine contractions, or by instrumental delivery.[1]

As has been previously stated, very active uterine contractions are not to be regarded as pathological in a normal condition of the birth-canal, and normal presentation and size of the fœtus, and therefore require no active interference. The woman should be in bed, and lying upon one or the other side; she should be directed not to make any bearing-down efforts, but keep her mouth open, refrain from pressing against any object with her feet, or grasping one with her hands during a uterine contraction. But if the unyielding condition of any portion of the birth-canal renders tearing probable from the rapidity of the labor, free inhalation of chloroform must be used to moderate the uterine force. Charpentier recommends chloral, Wigand advised opium, Grenser a rectal injection of laudanum, and others hypodermatic injection of morphia; but probably the promptest and best effect will be had from inhalation of chloroform. Care must be taken in the third stage of labor to see that the uterus undergoes its normal retraction.

B. *Deficiency of Uterine Force.*—Here the uterine contractions fail in intensity, in duration, and in frequency; this condition results in "tedious labor." Feebleness of uterine contractions is much more frequently met with than the condition just described, and it may occur in any one of three stages of labor, though most frequent in the first. It varies in degree and continuance, and may end in an actual cessation of uterine activity, which is commonly known as inertia of the uterus. The immediate danger to the mother from weak uterine contractions is greatest in the third stage of labor—for then hemorrhage is the inevitable consequence. Delay in the first stage of labor if rupture of the membranes has not occurred is not attended with danger to the child, or immediate danger to the mother; indeed, in very many cases, she suffers no injury immediate or remote from this delay. But if the amniotic liquor has been in large part discharged some risk comes to the fœtus, though probably this is not as great as some have thought, for complete emptying of the liquor is exceedingly improbable; especially if there be a presentation of the

[1] In the British Medical Journal, October 24, 1885, a case of emphysema in labor is reported, in which the entrance of air into the connective tissue of the neck and upper part of the chest, is supposed to have occurred through a small denuded surface about the middle of the right cheek in the cavity of the mouth—certainly a very singular hypothesis.

vertex, there usually remains filling up the interstices in the fœtal ovoid a considerable quantity of the fluid, so that the cord is protected from injurious pressure. Most practitioners of even a few years' obstetric experience have met with cases where discharge[1] of the amniotic liquor occurred twenty-four hours, or even three or four days before labor came on, and the labor in most instances ended in the birth of a living child. Delay in the second stage of labor is serious for both mother and child, for supposing the head to have entered the pelvic cavity it may produce by continued pressure upon the mother's soft parts inflammation and sloughing with consequent rectal or vesical fistulæ; even if openings into adjacent cavities are not produced, the injury to tissues opens the door for septic infection; the child suffers from prolonged pressure, and fatal asphyxia is the not uncommon consequence. The mother's life is endangered by the exhaustion which follows long-continued powerless labor.

It sometimes happens that weak and inefficient pains are associated with unusual suffering—the pains are very "painful pains." In some cases at the close of the first stage of labor, and immediately after the evacuation of the liquor amnii, a pause occurs in the labor; there is an absence of uterine contractions, or these are very feeble, and this condition may, though it is not common, last some time unless means are used to evoke the languishing, or the delayed uterine force. The patient, usually a multipara, is herself surprised that the pains have ceased; the practitioner upon making a vaginal examination finds the head still within the uterus, the cervix perfectly relaxed, and its walls hanging in loose folds, and a perfectly normal condition of the remaining portion of the birth-canal; a few vigorous pains, assisted by abdominal efforts, are apparently all that is needed to effect the expulsion of the child. Longer labor-pauses sometimes occur before the discharge of the amniotic liquor; labor has come on, and some degree of dilatation of the os been accomplished, then uterine action, which has been manifest for hours, gradually ceases, and the patient goes to sleep, often to the surprise, if not the disappointment, of attendants who expected that in a few hours the labor would be over; twenty-four hours may pass before the labor is resumed. Such cases are not to be regarded as pathological, the cessation of uterine contractions is very different from that observed when the uterus has for hours vainly struggled against some invincible obstacle, until its force is exhausted. The condition last mentioned is most frequent after the rupture of the membranes, and in the second stage of labor.

Voluntary force may be feeble, the abdominal contractions failing to contribute their part to the progression of the fœtus. This failure, in the majority of cases, occurs when uterine contractions are attended with much suffering; the patient refrains from making any effort lest she may add to that suffering. Again, voluntary effort may fail from the general weakness of the patient, or from her being profoundly narcotized.

[1] See page 344 for instances where discharge of amniotic liquor occurred even weeks before labor.

Causes of Weak Pains.—Failure of uterine force may arise from previous exhaustion, or from that caused by protracted labor; the uterus has grown weary in its work, and falls into a condition of inertia. It may be the result of deficient uterine innervation, or it may be caused by excessive uterine distension, as from hydramnios, or from the presence of more than one fœtus; the upper portion of the uterus being thus thinned it cannot triumph over the normal resistance of the os. A full bladder or a loaded rectum may hinder normal uterine action. Kleinwächter has drawn attention to the fact that failure of uterine contractions may result from an artificial cause, as, for example, if during the course of labor the forceps is applied and unsuccessful attempts at extraction are made, the labor-activity may be permanently interrupted, Mental influences may, temporarily at least, cause the labor to lag, the uterine contractions becoming weak and inefficient. A woman depressed by fear or anxiety, or offended by the presence of some one to whom she has an antipathy, or wounded by the unkindness of some one the nearest to her, and to whom she ought to be the dearest in this her hour of sore trial, and possibly of great peril, may have weak uterine contractions thus caused.

Prognosis.—This depends upon the stage of labor in which feeble pains occur; upon whether the membranes have been ruptured or are still entire; upon the causes of the condition; upon the general state of the mother, and upon that of the child. In the first stage of labor, the membranes being unruptured, as a rule the child does not suffer; but the prolongation of the first stage is in many cases not a matter of indifference as far as the mother is concerned, for she may be deprived of sleep, become discouraged by the delay, and exhausted by her fruitless suffering, which exceptionally continues for several days. Charpentier mentions a case in his practice in which dilatation was not accomplished, notwithstanding all means employed, until five days; the delivery was then made by the forceps. In Greek mythology a case where labor lasted nine days is given.[1]

The gravity of the condition if it occurs in the second or in the third stage of labor has been sufficiently pointed out.

Treatment.—Here we must carefully distinguish between physiological and pathological labor pauses, for in the former we abstain from active interference, while in the latter it may be imperative, and often must be prompt. Again, for their wise treatment a recognition of the causes of weak pains is essential, and also the period in labor of their occurrence, and the condition of mother and of child. If the contractions are attended with excessive suffering we have in chloral one of the best of agents for the relief of that suffering. If feeble uterine contractions occur in the first stage wearying and exhausting the

[1] Latona, pregnant by Jupiter, and her labor at hand, was pursued by jealous Juno, and at last found secure retreat in the island of Delos. Her labor lasted nine days and nine nights, when, seizing hold of a palm tree, she gave birth to Apollo, the god of medicine and of music. The position she took to end a protracted and difficult labor might be adduced as an argument in favor of delivery being effected while the woman is erect or leaning forward. It may also be mentioned from the legend we learn that Artemis, the twin sister of Apollo, was born twenty-four hours after—an interval that, as has been previously stated, may sometimes occur in the birth of twins.

patient while dilatation of the os almost, if not quite, fails, the membranes being unruptured, we may imitate nature's action in many cases, and create a temporary labor pause by the administration of morphia; after a sleep of a few hours it is not unusual for uterine action thus temporarily suspended, to return with normal vigor. The practitioner should know that the bladder and rectum are completely emptied. Where the want of uterine contractions arises from a want of innervation of the uterus, a change of position, especially from the recumbent to the erect, or walking for a time, may produce a favorable alteration. Similar action may be accomplished by a stimulating injection into the rectum, or by hot water vaginal injections; taking a moderate quantity of food, or a cup of hot tea, or a glass of hot lemonade is in some cases followed by increase of uterine action. If the uterus fails to contract because of its excessive distension, rupture of the membranes is indicated when certain conditions are present, though the os is only partially dilated but dilatable. Even though there may not be obviously great uterine distension, partial evacuation of the amniotic liquor is often followed by vigorous uterine contractions. Charpentier states that the following conditions must be present: 1. The cervix must have attained a certain degree of dilatation, and as far as possible it must not be rigid. 2. The presentation and position must be good, that is, the head must present, and the position must be anterior. Sometimes rupture of the membranes is more injurious than beneficial in posterior positions of the vertex. 3. The pelvis should be normal; in some cases, however, rupture of the membranes is of value in case of a narrow pelvis. 4. There must be no complication, such as prolapse of one of the members, or of the cord, etc. "Practised with these precautions and in these conditions rupture of the membranes has rendered us great benefit. But we cannot too often repeat one ought not to act too soon. Hasty intervention is in the majority of cases more dangerous than expectation." The introduction of Braun's colpeurynter into the vagina, or of a flexible bougie into the uterus, placing it between the ovum and the uterine wall, have been used for the purpose of exciting uterine action, and each has sometimes been successful. The use of the forceps in the first stage of labor after the rupture of the membranes, not for the purpose of extraction, but simply to bring the head down so as to press upon the os uteri, during uterine contractions, and effect dilatation, has been advocated, in this country especially by the late Albert H. Smith,[1] and by Professor Isaac E. Taylor.[2] The former has given the following directions as to this use of the forceps: When the os uteri is sufficiently dilated to allow the introduction of the blades, they may be carefully applied, and during each uterine contraction the head may be drawn down gently, and with as little compression as may be required to keep the blades in place. We have then nature's own dilator, supplemented by art simply for the increase of its powers, without any change in the method of action, no new plan of operation being introduced. The application of the forceps before the os is dilated can only in exceptional cases be advisable.

[1] Medical and Surgical Reporter, 1877.
[2] Transactions of the American Gynecological Society, vol. iv.

Digital dilatation of the os uteri will prove in the majority of cases demanding intervention either in the interest of the mother or of the child, after spontaneous and premature rupture of the membranes, a better method than the use of the forceps, at least in the hands of the majority of practitioners. Dilatations by means of rubber bags may in some cases be substituted for that by the fingers. Artificial dilatation can, as a rule, be more readily effected if chloral be first given. In labor delayed by insufficient uterine contractions fœtal expression has been proposed by Kristeller,[1] and advocated especially by him and by Suchard,[2] though Kleinwächter states that it accomplishes no more than friction of the fundus of the uterus.

The following are the directions given by Kristeller for the application of his method:—

The patient lies upon her back, near the side of the bed; by percussion and palpation the limits of the uterus are defined, the neighboring organs are isolated, and the intestinal folds separated. If the uterus incline too far anteriorly or laterally, it is brought into the axis of the inlet. It is then embraced by the hands, their cubital border being directed toward the pelvis, and their palmar face applied to the sides and to the fundus of the uterus, the thumbs being upon the anterior face. The fingers are now directed as far as possible behind the uterus; this succeeds very easily in case of a multipara whose abdomen is relaxed and yielding, and in a pluripara after the birth of one child. Next press gently the abdominal walls against the uterus thus embraced at the superior part; gradually increase the pressure; after keeping up this pressure for a certain length of time, it should be gradually diminished. The pressure upon the fundus of the uterus should be directed from above below, while that upon the sides converges toward the axis of the organ. The duration of the compression will vary from five to eight minutes; it may be repeated at intervals of from one-half a minute to three minutes during a period of ten, twenty, or forty minutes, according to the urgency of the case, the period of labor, and the sensibility of the patient. In this succession of intermittent compressions thus made, it is sometimes necessary to act upon the fundus, sometimes upon the upper and lateral portions of the uterus, never forgetting that when the os is but slightly opened, not readily dilatable, and its diameter not more than five centimetres, nearly two inches, the pressure should be less upon the fundus, more upon the sides of the uterus. On the other hand, when the os is more dilated and yielding, compressions of the fundus produce the best effects. In difficult cases a longer pause, from ten to fifteen minutes, should be made after ten or fifteen compressions. Toward the end of the labor the place of applying pressure should not be changed, it can scarcely be made except at the fundus of the uterus. Kristeller directs that, as a rule, if twenty to thirty compressions properly made produce no result, it is better to desist.

Medicines may be administered for increasing uterine contractions; the chief of these are quinine and ergot. It is asserted by reputable observers that the former given in doses of ten to twenty grains has this effect. Wood[3] attributes the result not so much to a specific action of the remedy upon the uterus as by its arousing the general

[1] Monat. f. Geburt., 1866. [2] De l'Expression Utérine appliquée au Fœtus.
[3] Therapeutics, Materia Medica, and Toxicology.

nervous forces of the system. Kleinwächter explains the apparently beneficial effect of quinine as resulting from reduction of abnormal temperature; after the fever abates the pains frequently increase spontaneously, and succeed each other rapidly, but not in consequence of the quinine.

The late Dr. Albert H. Smith stated[1] that in forty-two women, to each of whom he gave fifteen grains of quinine after actual labor-pains had begun, he observed within fifteen minutes a decided increase in the frequency and vigor of the contractions, a rapid progress of the labor, and where there was no obstruction, a speedy termination. He claimed that quinine not only increased the activity of the normal uterine contractions, but that it promoted permanent tonic contraction of the uterus after the expulsion of the placenta, that it lessened the lochial discharge in those who previously had it in excess, and that it also lessened after-pains in the majority of cases.

Ergot has been more generally given since its acceptance by the profession than any other agent to increase uterine contractions. Wernich's investigations show that it lessens venous tension, and while the blood in the veins increases, that in the arteries diminishes; anæmia of the uterus and its nerve-centres occurs, and hence the uterine contractions become more powerful and longer. According to Wood's statement,[2] if ergot be given in small doses during labor, the natural pains are simply intensified; but if the dose be large enough to have a decided effect, their character is altered; they become not only more severe, but much more prolonged than normal, and finally the intervals of relaxation appear to be completely abolished and the intermittent efforts are changed into one violent, continuous strain. Ergot was introduced into American practice in 1807,[3] and received the name of *pulvis ad partum;* but as fatal results at least to the child followed its use, Dr. Hosack suggested that it should be called *pulvis ad mortem.* Many reputable obstetricians to-day reject the use of ergot during labor, some indeed insisting that it should be banished from obstetric practice. It is believed that this is a mistake, and it is unjust to conclude that because there has been gross abuse in the administration of the agent—it has been given in unsuitable cases, at improper times, or in too great quantities—it should therefore not be used at all.

The form in which it is most frequently given is that of fluid extract, each minim of which represents one grain of the powdered drug. A preparation called ergotine, though Squibb denies the right to this name, is also used; each grain of ergotine is supposed to represent five minims of the fluid extract. The remedy is given by the mouth, and also used hypodermatically, in the latter case a watery solution of ergotine usually being preferred.

Ergot is not to be given in the first stage of labor. As has been stated in the consideration of the treatment of placenta prævia, both Wilson and Murphy place much reliance upon it, and give it without waiting for complete dilatation of the mouth of the womb. Nevertheless, the rule is as has been stated, and exceptions to it are

[1] Transactions of the College of Physicians of Philadelphia, 1875.
[2] Op. cit.
[3] Medical Repository, 1807.

very rare. Next, it should not be given unless the labor be so far advanced, and the conditions of presentation and of the birth-canal are such that an early delivery may be reasonably expected should the uterine force be made normal. Probably the most important rule in regard to its administration, however, is that it must be given in such amount that the normal contractions of the uterus shall be increased; the use of large doses, so that the uterus is roused to continuous action, may be followed, and too often has been, by rupture of the uterus, of the vagina, or of the perineum, and by the death of the child from asphyxia. Ten drops of the fluid extract, or an equivalent quantity of the infusion, or of ergotine, once in fifteen minutes, is a suitable dose when the remedy is required during labor; if given for uterine inertia after labor, the dose should be not less than a teaspoonful. Kleinwächter advises combining Wernich's ergotine with tincture of cinnamon, a teaspoonful of the latter at each dose, stating that it then acts more efficiently; it might be well, therefore, to give ten drops, for example, of the fluid extract with a teaspoonful of the tincture of cinnamon in two tablespoonfuls of water. He also recommends as useful in weak uterine contractions occurring either before or after dilatation of the os uteri a bath at a temperature of from 82.4 F. to 84.2 F.; the woman remains in the bath for at least twenty or thirty minutes, and its temperature must be maintained by the addition of warm water from time to time.

The same authority remarks that electricity which has recently come into vogue again, is unreliable. On the other hand, the use of faradization has recently been strongly advocated by Dr. Baird, of Texas. He claims that the action of electricity is certain, and that it need never fail to produce uterine contractions.

The following[1] is the description given by Dr. Baird of his method:—

The patient is placed in a dorsal position. I then attach one cord to the copper plate, and covering it well with a napkin wet with warm water, apply it to the sacro-lumbar region. The other cord I attach to the wrist electrode. I now set the machine in action and attach both cords to it, the one connected with the plate to the positive pole. Then slide it under the bed or couch, where it and the cords will remain out of the way of the necessary attendants. The wrist electrode I now attach to one of my wrists, first covering the wrist with a napkin wet with warm water, then close the circuit by applying the hand, well moistened with warm water, of that wrist to the abdominal wall. By this means I am able to determine the exact condition of the uterus, and to note correctly all the changes which may occur in its contour, and I can also estimate the amount of increase which occurs in its contractions, and I am also enabled to perform uterine manual pressure, and if it is necessary to use both hands for this purpose it can be readily done, and each hand then conveys the current to or from the uterine walls."

Dr. Baird directs beginning with mild currents, gradually increasing them to the desired strength. He makes the application with the hand "continuous until a sufficient amount of sedation is produced, from five to thirty minutes, then I open the circuit by removing my hand during the interval between the pains, and close it again when the pain recurs."

[1] American Journal of Obstetrics, 1885.

The following are the indications given by him for the use of electricity as an oxytocic:—

"1. To modify the pains of labor. 2. To favor a more rapid dilatation of the os. 3. To promote more vigorous uterine contractions. 4. To add tone and strength to all the muscles engaged, and 'increase their power of doing work.' 5. To abridge the time occupied by the labor. 6. To prevent shock, exhaustion, and post-partum hemorrhage. 7. To insure contraction of the uterus in cases of instrumental delivery. 8. To act as an auxiliary in the induction of premature labor. 9. To arrest hemorrhage, and accelerate labor in cases of placenta prævia. 10. To prevent an undue expenditure of nervous force in all cases of debility from whatever cause, thus leaving the patient in a condition to secure a speedy and favorable convalescence."

I have thus presented the extraordinary claims in behalf of electricity in obstetric practice advanced by Dr. Baird, but other observers and longer experience must test their value; most probably some at least of the indications he has given will be rejected.

Dr. Mary Putnam Jacobi[1] has reported a case of labor at seven months in which dangerous delay occurred from rigidity of the os. All the usual and approved means of relaxing the rigidity, including chloroform inhalation, had been used unsuccessfully, when she resorted to faradic electricity; a small electrode was applied to the os, the other held in the patient's hand, and the application was continued fifteen minutes. Immediately afterwards the introduction of the finger into the os, heretofore impossible, was readily done, and artificial dilatation followed by delivery with the forceps.

If after the rupture of the membranes and complete dilatation of the os labor does not advance, instrumental delivery will in many cases be the best resort both in the interest of the mother and of the child. "When the head has remained two hours in the vagina without making any progress, we do not wait, but end the labor by the application of the forceps."[2] This is done in the interest of the mother, though the child may not be suffering; in some cases the condition of the latter will not permit even this delay, and instrumental delivery must be at once employed.

Feeble and inefficient uterine contractions in the third stage of labor usually have as their consequence uterine hemorrhage, and under this head they will be considered.

C. Perversion of uterine force may be manifested by continuous general or by partial uterine contraction; the former is sometimes called tetanic, while the latter causes what is known as a stricture. Tetanic or continuous contraction of the uterus occurs oftener in old primiparæ; it may be caused by ergot given at an unsuitable stage of labor, or in too large a quantity; by irritation of the os from frequent examinations or other interference with the progress of labor, or result from disproportion between the size of the fœtus and the pelvis, the uterus struggling to overcome great, or invincible resistance. The condition is generally associated with severe suffering. Of course the so-called

[1] American Journal of Obstetrics, Jan. 1886. [2] Charpentier.

tetanic contraction of the uterus, if there be no hindrance to the birth, simply causes this to occur more rapidly; but if there be such hindrance, as from a mal-presentation, or from pelvic deformity, rupture of the uterus is liable to occur. This condition, too, makes difficult or impossible the introduction of the hand into the uterus for rectifying an unfavorable presentation or position. It usually occurs after the rupture of the membranes, and hence may interfere with the utero-placental circulation, or produce direct pressure upon the cord, and in either case the child may perish from asphyxia.

Chloroform given until deep anæsthesia is produced will be necessary in cases demanding an obstetric operation, *e. g.*, podalic version in presentation of the shoulder. Fränkel advises a hypodermatic injection of morphine and of atropine to be given before the chloroform inhalation; in five or ten minutes the uterus relaxes, and the introduction of the hand can be readily made. Charpentier directs chloral by rectal injection if the spasmodic condition occurs in the first stage of labor, but if in the second, chloroform inhalation.

Partial uterine contraction is usually an accident of the third stage of labor; in its most common form it is known as hour-glass contraction. In the great majority at least of these cases the condition is not pathological; there is general contraction of the uterine body while the cervical canal remains relaxed, and the apparent stricture is, according to most, the normally contracted internal os, while the placenta remaining in the uterine cavity prevents the complete approximation of its walls.

Kleinwächter denies the existence of partial uterine contractions, or partial uterine spasms, but asserts that in consequence of the relations of the muscular fibres to each other, the uterus must contract as a whole. The so-called spasmodic contraction of the external os uteri is nothing more than a condition in which the upper part of the uterus has not manifested enough power to overcome resistance; the os is only slightly dilated, and it presents sharp edges, but as soon as the contractions have become more vigorous it opens, and the so-called spasm ceases. Again, in the third stage of labor, the placenta may not be detached spontaneously, in consequence of adhesions, and the uterus takes the form of an hour-glass. The relaxed lower uterine segment represents a funnel, the narrowest portion of which is above. The upper portion of the uterus contracts around the remaining placenta, and immediately below the walls of the body meet, as nothing intervenes; but the lower segment is found, as after every normal birth, in a condition of partial paralysis, that is, it is relaxed. The so-called stricture, therefore, is not a pathological phenomenon, but is the normal condition after the delivery of the child. While this is the most frequent form of stricture, and, as Kleinwächter states, is not a pathological condition, yet the recent investigations of Bayer[1] seem to prove that from the anatomical construction of the uterus strictures may occur at various parts of the organ. Clinical observation, too, confirms this view, though the occurrence of such cases is exceedingly rare.

Excessive pain in labor may be caused by very great distension of the uterus, by peritoneal inflammation, by mal-presentation, or great

[1] Op. cit.

size of the fœtus, or it may arise from a general hyperæsthetic condition. It does not interfere with the action of the uterus, but it does prevent the assisting action of the abdominal muscles in the second stage of labor.

In the treatment of excessive pain, of course, the cause must be ascertained, and, if possible, removed; but in many cases remedies must be given directly to remove the suffering; for this purpose we may use chloral or laudanum by rectal injection, or morphine hypodermatically, or anæsthetic inhalation.

Anomalies of the Form and of the Position of the Uterus.—The arrest of pregnancy in a rudimentary horn of the uterus has been stated in connection with the subject of ectopic development of the ovum. But in the cases where the pregnancy has occurred in the fully developed horn, either of a uterus unicornis or bicornis, its course has been uninterrupted and the labor normal; nevertheless, in some instances of the latter malformation it is stated that the unimpregnated horn has interfered with the entrance of the fœtus into the uterus, and that there is a greater liability to a transverse position of the fœtus. Instances have occurred where both horns were pregnant, the labor taking place in each at or near the same time; in other cases there has been an abortion from one horn, while the pregnancy in the other was completed. Cruveilhier has mentioned a curious instance of double uterus with duplicity of the vagina also, the woman being pregnant; she was visited by one physician who asserted that she was not pregnant, and then by another who found her in labor; the difference of opinion arose from the fact that one practitioner made a digital examination through the vagina which communicated with the non-pregnant half of the womb, while the second making his through the other vagina, recognized the dilatation of the os and the presenting part of the fœtus.

Latero-positions of the uterus, though usually rectified by uterine and abdominal contractions bringing the uterine in correspondence with the pelvic axis, can easily be corrected if necessary by having the patient lie upon the side opposite to that of the displacement. Anteversion or anteflexion is remedied simply by the dorsal position, or by the abdominal bandage; Dr. Barker[1] states that in some cases of pendulous abdomen he has been obliged to place the patient in the dorsal position, her head and shoulders being considerably lower than her hips.

Prolapse of the uterus can only occur in case of a very large pelvis; very rarely the head passes out still inclosed in the lower uterine segment.

Occlusion and Narrowing of the Os Uteri.—Conglutination of the external orifice is occasionally met with. The labor is tedious, the lower uterine segment greatly thinned, and upon digital examination no os can be felt, but usually a slight pit or depression marks its place, though sometimes this may fail; the closure in most cases is simply from a thickened secretion, but may be consequent upon a superficial endometritis. During a contraction of the uterus pressure should be

[1] Transactions of the American Gynecological Society, vol. v. p. 274.

made with the point of the finger, or with the uterine sound at the depressed place, or if this be absent at that which is most thinned, and the os will open; it may be widened simply by the finger, or, as in a case[1] reported by the late Dr. Albert H. Smith, by means of a uterine dilator.

In rare cases it happens that the union between the maternal and fœtal membranes in the immediate vicinity of the external orifice is so firm that the lower segment of the uterus cannot retract over the ovum. Should this be the case, detachment of the membranes or rupture of the amniotic sac is indicated.

Cicatricial closure of the os may have resulted from an inflammation following a previous labor, or from the application of powerful caustics to the cervix. It is rarely complete, and if there be atresia, of course, it must have been developed subsequently to impregnation. In most cases, even of atresia, nature is able to triumph over the obstacle, but the dilatation may require one or two days; it is rarely necessary to resort to incisions.

Under the different names of anatomical, simple, or mechanical rigidity of the os, a condition is met with, especially in old primiparæ, which causes great delay, and in rare cases presents an invincible obstacle to labor. The cervix has not been completely effaced, and the borders of the os are thick, resistant, hard, but not sensitive. In some instances the neck is hypertrophied, and in these it is not unusual to find after labor has continued for some time a thrombus involving the anterior or posterior lip. At first warm baths, warm vaginal douches, and a laudanum injection into the rectum may be tried, then artificial dilatation; Schroeder advises incisions freely made by curved scissors or by a probe-pointed bistoury.

Neoplasms of the Uterus—(Fibroid Tumors and Cancer).—The injurious influence of uterine fibroids upon labor depends upon their size and their position. If the tumors are small, or subperitoneal, they may present no complication, and, indeed, may not be recognized in some cases until the labor is over. Tumors of the neck, when large, prevent the presenting part from entering the pelvis; interstitial tumors of the body may be the cause of rupture of the uterus, or of post-partum hemorrhage, especially if the placenta be attached to the part of the uterine wall which they occupy. The relative proportion of fibroids of the neck to those of the body is much greater in pregnant than in non-pregnant women. Thus, while there are twenty cases in which these tumors are situated in the body to one where such a growth occupies the neck of the uterus in the non-pregnant, the proportion is only five to one in the pregnant, as ascertained by Chahbazian from the study of 310 cases of uterine fibroids complicating pregnancy.[2]

Chadwick[3] has reported ten cases of pregnancy and labor complicated with fibroids, with the following results: 1 miscarriage, 7 recoveries of mother and 7 living children, 2 deaths of mothers and 2 stillborn children. Fortunately in one-half of cervical fibroids observed

[1] Medical and Surgical Reporter, 1877.
[2] Des Fibromes du Col de l'Uterus au point de vue de la Grossesse et de l'Accouchement.
[3] Boston Medical and Surgical Journal, July 30, 1885.

in pregnancy or labor, the tumors are pedunculated, 38 out of 76, according to Chahbazian's statistics. Another notable fact is that transverse and pelvic presentations are greatly increased so that the two nearly equal the number of vertex presentations. In Chadwick's cases there were in 9 labors 7 head presentations and 2 transverse.

In the treatment of fibrous tumors of the uterus complicating labor, Lefour advises at first to wait, letting nature accomplish all she can, but this delay must be determined by the interest of the mother and child. Next, act upon the tumor by its removal, or by pushing it up from the pelvis. Extirpation of the tumor was first performed by Michellacci in 1791.[1] The operation has been repeatedly done since, and with almost unvarying success as far as the mother is concerned,

FIG. 147.

A POLYPUS OCCUPYING THE PELVIC CAVITY IN LABOR.

but with a very large fœtal mortality. As in a large proportion of cases the tumor is cervical, and as in one-half of these it is pedunculated (see Fig. 147), its removal will, under such circumstances, usually be neither difficult nor dangerous. If the tumor has no pedicle it must be enucleated. But other tumors may occupy such a position that they cannot be removed, as, for example, a sub-peritoneal growth with a long

[1] See Chahbazian, op. cit.

pedicle that has dropped into the pelvis, or a tumor involving the neck and the lower part of the body of the uterus. Here an effort must be made to push it above the pelvic inlet. The patient is put in the knee-chest position, and the fingers or the entire hand introduced into the vagina and used to press the tumor out of the way; of course pressure should be made only in the intervals between contractions. If it is impossible to either extirpate the growth, or to remove it from the pelvis, and space permit, the forceps or podalic version may be next tried. The results from the forceps are very much more favorable than those given by version, and therefore the former method of delivery is to be preferred. In 20 cases[1] of applications of the forceps, 12 mothers and 8 children were saved, while in a like number of versions only 7 mothers and 3 children were saved. Embryotomy is the next resort; but while, of course, all the children are lost, it gives a fearful mortality for the mothers, 66 per cent. of them perishing. The Cæsarean operation has been regarded as the final resort, and general statistics have shown it to be unusually fatal when performed on account of uterine fibroids. One reason for this peculiarly great mortality is, that its performance is generally delayed until the patient is so exhausted her condition is well nigh hopeless.

Cancer of the uterus gives a very unfavorable prognosis; Cohnstein found that of 126 mothers only 54 survived, while 72 died during labor or in the puerperal period. If the disease partially affects only the lips of the uterus, labor may go on without special difficulties, and there may be no great hemorrhage. But if the entire cervix be affected, and especially if the disease has extended to the adjoining part of the body of the uterus, it is impossible for the diseased tissue to dilate, and the expulsion of the fœtus can only occur after rupture of the unyielding ring, which causes such a serious hemorrhage that may be difficult or impossible to arrest. Incisions of the cervix thus degenerated are dangerous because of consequent hemorrhage, and, according to Kleinwächter, because they must be carried through the entire wall and thus injure the peritoneum; nevertheless, Charpentier advises them, and directs that they should be followed by the application of the forceps. Hermann[2] states that "when labor has actually come on, expansion of the os uteri should be aided by making numerous small incisions in its circumference." He also says that when dilatation is in progress, if it is necessary to accelerate labor the forceps is preferable to version. When the disease, however, involves the entire cervix, the timely performance of the Cæsarean operation is plainly indicated, both in the interest of the mother and of the child.

Anomalies of Adjacent Organs.—Chief among these which may interfere with labor are tumors of the ovary, the danger or difficulty depending upon their size, position, mobility and nature. Thus, an immobile, solid tumor in the pelvis is more serious than a fluid cystic tumor. Even if the tumor furnished no obstacle to the birth, there may be, as Kleinwächter states, twisting of the pedicle during labor, and this be followed by rupture of the cyst in childbed with fatal peritonitis. Dermoid cysts give a more unfavorable prognosis than

[1] Chahbazian, op. cit. [2] London Obstetrical Society's Transactions, vol. xx.

those which are liquid, because they are fixed, and their contents solid, so that they as a rule cannot be pushed out of the way, nor their size lessened by puncture. Fibroid tumors of the ovary, especially if calcareous change has occurred, may cause great difficulty by de-

FIG. 148.

AN ENLARGED OVARY BLOCKING UP THE PELVIC CAVITY IN LABOR.

scending into the pelvis in advance of the presenting part of the fœtus, and thus preventing its progress; on account of their hardness it is very difficult when they have thus become fixed, to distinguish them from pelvic exostoses.[1]

Remy[2] sums up the treatment of ovarian tumors interfering with labor as follows: Do not delay intervention too long; begin by puncturing the tumor, and if this fails, make an incision with proper precautions. As means of extraction the forceps is preferable to version, but each operation is dangerous in case of rupture or inflammation of the cyst. In case of failure craniotomy and the Cæsarean operation remain; statistics in regard to the mother are more favorable when craniotomy is done. If the abdomen is opened an effort should be made to remove the tumor, and not resort to section of the uterus until after this has failed.

[1] Kleinwächter, op. cit.

[2] Op. cit.

Rectocele and Cystocele.—Obstruction of the vagina from projection of the rectum loaded with feces, or of the bladder filled with urine can scarcely offer a serious hindrance to childbirth, especially as the obstetrician gives heed early in the labor to having each of these organs thoroughly evacuated. Ramsbotham, however, has stated that he has seen many instances of the bladder prolapsing before the head, and mentions two cases where it was punctured, one practitioner mistaking it for a dropsical head, and the other for the bag of waters. Such errors can only result from culpable ignorance or carelessness.

FIG. 149.

THE BLADDER DISTENDED AND PROLAPSED BEFORE THE HEAD OF THE CHILD.

Vesical calculi have in very rare cases obstructed the birth-passage. It will generally be easy to push a tumor thus formed up out of the pelvis; if not, an opening may be made into the bladder from the vagina, and the stone or stones removed, after which sutures are to be introduced as in the operation for vesico-vaginal fistula.

Vaginal cicatrices, consequent in most cases upon inflammation following a preceding labor, may require to be divided by bistoury or scissors; similar treatment may be necessary in case of a resisting hymen opposing the descent of the head, though in the majority of cases this is unnecessary.

CHAPTER VI.

PATHOLOGY OF LABOR (*Continued*)—FŒTAL DYSTOCIA.

Fœtal dystocia includes dorsal displacement of the arm, excessive size of the fœtus without, or resulting from, pathological cause, difficult labor in plural pregnancy, the delivery of monsters, and unfavorable and complex presentations.

Dorsal Displacement of the Arm.—This has occurred in vertex as well as in pelvic presentations. In the former variety Sir James Simp-

Fig. 150.

Dorsal Displacement of the Arm.

Fig. 151.

Dorsal Displacement of the Arm in Footling Presentation.

son, who first described the displacement, advised bringing the arm down, thus making a complex presentation, that of the hand and head. Playfair thinks it better to perform podalic version, and has done it successfully after having failed to deliver with the forceps. If the displacement occurs in head-last delivery, Barnes advises rotating the

child in the opposite direction to that rotation which he believes caused the difficulty. "By rotating the child back in the contrary direction, so as to restore the original position, you may possibly liberate the arm. At any rate, you will render more easy the further proceeding that may be necessary. You carry the trunk well backwards, so as to give room to pass your forefinger in between the symphysis pubis and the child's shoulder; and hooking on the elbow, draw this downwards, and then forwards. It may be useful, as a preliminary step, to gain room by first liberating the other arm."[1] Barnes further states that if the arm cannot be liberated, craniotomy may be necessary.

Great Size of the Fœtus.—This may relate to the head only, or the body also. The diagnosis of great size of the fœtal head prior to birth is uncertain; abdominal palpation previous to labor, or during labor, and by touch finding the distance between the anterior and the posterior fontanelle is greater than usual, are thought by some to furnish useful information. Could we know the sex of the child we might be assisted in the diagnosis of the size of the head. In multiparæ advanced in age it is usual to find that the child if male has a very large head. In primiparæ more than thirty years of age the children are larger than in young primiparæ. Possibly the patient's previous labors have been protracted in consequence of the great cranial development with premature ossification of the bones of the head, and they all may have ended in the birth of dead children. In case of prolonged pregnancy, as a rule, the development of the fœtus, especially of the head, is greater than if the labor occur at the normal time.

The subject of premature ossification of the fœtal head as a cause of dystocia has been presented by Blake. He takes the ground that it would be a very judicious rule of practice in any dystocia caused by a large and prematurely ossified fœtal cranium not to consider the question of forceps delivery. "We may resort to the perforator with less than our usual repugnance to its use if we bear in mind the fact that quite a proportion of children born with closed or partially closed fontanelles and ossified sutures will, if not early cut off with symptoms of brain irritation and pressure, be epileptic and idiotic."[2]

Jacobi states that premature ossification of the sutures and fontanelles occur particularly with the first child, and in the milk of young mothers the phosphates are predominant as compared with the milk of mothers later in life.[3]

The induction of premature labor is clearly indicated in the case of a pregnant woman whose previous pregnancies have ended in stillbirths from the great cranial development of the children. One of the most frequent causes for the application of the forceps is the necessary disproportion which exists between the head and the normal pelvis if the former be unusually large; turning is not advisable, but in some instances craniotomy may be necessary.

Jacquemier has said that after the spontaneous or artificial delivery of the head, it was thought by some the shoulders became too large

[1] Obstetric Operations.
[2] American Journal of Obstetrics, vol. xii. [3] Ibid., p. 358.

by development of the chest, and presented an obstacle to the escape of the fœtus so that it was impossible for the uterus alone or assisted by the usual artificial means to expel it, at least as promptly as required by its precarious situation thus suspended between intra- and extra-uterine life. It is not, however, the great volume of the shoulders so much as that of the chest which causes the delay, conjoined with some degree of uterine inertia. When this difficulty is anticipated the practitioner must beware of deep anæsthesia, provided an anæsthetic be administered, during the delivery of the head, lest, even if uterine inertia be not thereby invited, the voluntary expulsive efforts of the patient may fail when they are most needed. The special means necessary for artificial delivery of the shoulders have been stated on pages 432–5.

Great Size of the Fœtus from Pathological Causes.—1. *Hydrocephalus.*—By this is meant abnormal accumulation of serous liquid in the cranial cavity. It is met with once in 3000 births. It has been attributed to syphilis, alcoholism, cretinism, and to marriages of consanguinity. The mothers were, in some instances, past forty years of age, and lived in bad hygienic conditions. Poullet[1] states there are cases in which women have a predisposition of unknown nature to produce hydrocephalic offspring, and cites an illustration from Franck of one who had in successive pregnancies seven children with hydrocephalus, and another from Gœlis of one who had six. He also directs attention to the investigations of Dareste, who, in the artificial production of monstrosities, has caused dropsy of the nervous centres in experiments upon the embryo of the hen.

In hydrocephalus the cranial bones are usually much thinner than normal, and more flexible; they are flattened, are much more widely separated from each other, and the fontanelles larger, and in some cases the latter occupy a greater extent than the ossified parts. In many cases of hydrocephalic heads there is a supplementary fontanelle, known as the fontanelle of Gerdy, situated between the anterior and the posterior fontanelle.

The great development of the head interferes with the normal accommodation of the fœtus, and hence there is a much larger proportion of presentations of the pelvis. Poullet found in 106 cases 30 in which the pelvis and 8 in which the shoulder presented. So far there has been no example of face presentation in hydrocephalus.

If the enlargement be not very great, spontaneous delivery occurs after a more or less difficult and tedious labor: "But in the largest number of published observations the efforts of nature were entirely powerless to effect the expulsion of the hydropic head, and after alternatives of contractions and inertia from exhaustion of the uterus, final inertia supervened, or uterine rupture occurred, the woman dying undelivered; this, at least, is the course of spontaneous labor without more or less able intervention, when the head was large."[2] In some instances, however, delivery may occur by the fluid passing from the

[1] De l'Hydrocéphalie Fœtale dans ses Rapports avec la Grossesse et l'Accouchement. Paris, 1880.

[2] Poullet, op. cit.

interior to the exterior of the cranium, or it may become infiltrated in the connective tissue of the neck, of the chest and of the abdomen, thus producing a general œdema. A still more singular lessening of the size of the hydrocephalic head may result from the fluid passing into the pleural, or into the peritoneal cavity, and then the labor spontaneously ends. If the slow labor demands the application of the forceps, the introduction of the blades and the locking are difficult, the handles are wide apart, and efforts at traction usually end in the blades slipping. It should be added, however, that if Tarnier's forceps is used, this accident is much less likely to occur. I have thus delivered a hydrocephalic head when a Hodge's instrument had been unsuccessfully tried.

The diagnosis of hydrocephalus when the head presents is sometimes difficult, but the difficulty is still greater in presentation of the pelvis; in most cases of the latter it is not made until after the body is delivered, and then a delay arises from the difficulty or impossibility of the head entering the inlet. During this unexpected delay it is not unusual for the child to die. Possibly if a finger be now introduced so as to feel the occipital bone it will be found thinner, and less resisting than normal; by abdominal palpation it will be ascertained that the uterus is much larger than it should be after the delivery of the body of the fœtus; if there be difficulty in disengaging the arms the great distance to which the finger must be carried to effect this disengagement is a probable indication of a hydropic head.

Prognosis.—This is most unfavorable for the child. The statistics of Chassainat[1] show that in 60 cases of fœtal hydrocephalus 41 died before or during labor, and only 19 were born alive; only 4 of the 19 lived for several years. Poullet regards this result as too favorable, stating that—after searching for an instance where the hydrocephalus caused dystocia, and the infant lived—he has not found one.

Diagnosis.—If there is not an excess of liquor amnii it may be possible to recognize the great disproportion between "the round and voluminous tumor made by the head, and the other tumor at the opposite extremity of the fœtal ovoid, and which may be distinguished as the pelvis." Upon auscultation when the head is below, contrary to that which is usual in head-first labor, the sounds of the fœtal heart are heard most distinctly higher than the umbilicus. Combining digital examination, after labor has begun and the membranes have ruptured, with abdominal palpation, it has sometimes been possible to perceive distinct fluctuation between the touching finger and the palpating hand. By vaginal touch alone a large surface, less rounded than the normal fœtal head, is felt; it seems like the bag of waters at first, but a more careful examination proves that its walls are thicker and more resisting than those of the fœtal sac, and possibly the hair may be felt; during a uterine contraction instead of the scalp being wrinkled it remains smooth and tense; it may be difficult to recognize the fontanelles or sutures, for the membranous spaces intervening between the bones are wide, but it will be possible to touch

[1] Quoted by Poullet.

one of the cranial bones which will usually be found thin and quite yielding, and it is more flat and has a greater mobility. A macerated head, when the death of the fœtus has occurred some time before, may give similar increase of mobility, but there is no increase in the size of the head; the bones override during a uterine contraction, the sounds of the fœtal heart cannot be heard, and the mother has not recognized fœtal movements for some days.

Poullet's statistics including 106 cases, show that 21 mothers died; Spiegelberg found in 94 cases 24 deaths. In 74 cases collected by Keith there were 16 of rupture[1] of the uterus. Complications, such as polyhydramnios, placenta prævia, uterine inertia, rigidity of the cervix, etc., add to the gravity of the prognosis.

Treatment.—There is but one thing essential, and that is lessen the size of the head. Schroeder and some others advise puncture by a fine trocar with the forlorn hope that the child may survive, although he stated in 1880 that he knew no instance in which such survival occurred. The advantage of perforation is that the finger can be introduced into the opening, then curved so as to exert slight traction, thus, in some cases, speedily effecting delivery. Schroeder advises, immediately after the evacuation of the fluid, delivery by podalic version—this, too, was the practice of Georget in 1820—but if the uterus be retracted it may be ruptured during the operation, and most obstetricians prefer delivery by the head; the extraction may be made with the forceps, if the instrument does not slip, or if it does with the cephalotribe; Pajot[2] suggests delivery by taking a rod of wood two inches and a half long, to the middle of which a cord is attached, it is passed into the cranial perforation, which should be made through a bone, and not in one of the sutures or fontanelles, given a transverse direction, and then pulling on the cord the head may be extracted.

Perforation is advisable, too, in most cases where the pelvis presents, though in some the delivery may be effected by traction upon the lower limbs conjoined with supra-pubic pressure; this traction, however, has, in a few cases, torn the body away from the head, leaving the latter in the uterus, and therefore the force thus exerted should never be so great as to run this risk. Perforation has been made through the palatine vault, at the occipital bone, behind the ear, or through a lateral fontanelle. The almost insuperable difficulty in reaching the head with an instrument led Van Huevel to suggest an easier method of evacuating the dropsical fluid, and it has in some cases been successfully employed. The spinal canal is opened as near the body of the mother as possible by a transverse incision two inches long; then a rubber sound with a firm mandarin is easily made to pass through the opening and up to the cranium; upon the withdrawal of the mandarin the fluid readily escapes through the catheter, and the

[1] The late Dr. John Neill, of Philadelphia, reported in the Medical Examiner 1854–5, a case of very large spontaneous rupture of the uterus in a woman in her sixth labor, the child being hydrocephalic; he performed the Cæsarean operation twelve hours after the accident, removed the child from the peritoneal cavity, and the woman recovered.

[2] According to Poullet this method was first suggested by Augier about the middle of the last century.

head lessened in size may be readily withdrawn by traction on the body or lower limbs.

Sir James Simpson in the case of a woman who had in her two pregnancies hydrocephalic children, the delivery of each only being possible by cranial perforation, in her third pregnancy induced premature labor, and she gave birth to a living child.

2. *Encephalocele.*—The tumor formed by an encephalocele may be hydropic, though it is not often that the enlargement from this cause is so great as to furnish an impediment to birth, but if it should the treatment is puncture.

3. *Hydrothorax.*—This is rarely a cause of dystocia; it is seldom found independently of ascites, when it is, the latter is usually the obstacle to expulsion of the child.

4. *Ascites.*—This is commonly complicated with inflammatory lesions of the peritoneum or multiple lesions of the viscera contained in the abdominal cavity.[1] The quantity varies from ten or twelve ounces to several pints. The diagnosis is made during labor; after the expulsion of the head the body remains, and cannot be withdrawn by traction; if the hand is now introduced into the pelvis, and the abdomen of the child felt, the cause of the delay is recognized. The treatment is puncture with the trocar; in some cases the abdominal walls are so thinned that the perforation has been made by the finger.

5. *Hydronephrosis, Retention of Urine in the Bladder.*—Either of these may be the cause of dystocia—in regard to the former, see page 288—each requires tapping before the fœtus can be born.

6. *Diseases of Various Organs.*—Rogers has reported[2] a case of dystocia caused by fibro-cystic disease of the undescended testicles; excessive size of the liver, and hernia of the liver, cystic disease of the uterus, and aneurism of the aorta have also been rare causes of difficult labor.

7. *Different Tumors.*—It seldom happens that the tumor in spina-bifida is so large as to interfere with delivery, but in case it does puncture is necessary. Fibrous, cystic, and fibro-carcinomatous tumors may be so large as to require operative interference. The same remark is applicable to the tumor formed by fœtal inclusion; this may be superficial or profound; in the former case it is usually situated in the neck, scrotum, perineum, etc., and in the latter most frequently in the abdominal cavity. Two explanations of the origin of such a formation have been given: Either two separate germs have been successively fecundated, and one penetrates into the other—the theory of penetration, as it has been called—or an ovule containing two germs is fecundated, and one growing more rapidly incloses the other. In general it may be stated as to all these tumors when seriously interfering with labor, the liquid ones are to be lessened by puncture or by incision, and those that are solid by segmentation.[3]

8. *Single Monsters—Acardia, Acephalia, Anencephalia, Hemicephalia.*—An acardiac monster is described by Schroeder as originating from anastomosis of the vascular systems of twins contained in the

[1] Charpentier. [2] American Journal of Obstetrics, vol. ii. [3] Charpentier.

same chorion, consequently of the same sex, the blood pressure being greater in one than in the other; in the latter the circulation becomes too feeble, as a consequence the heart, the lungs, and a greater or less part of the trunk atrophy, and the monstrous fœtus is nourished at the expense of the one which is normally developed. The stasis thus produced in the umbilical vein which leaves it, may have as its consequence considerable hypertrophy and an œdematous tumefaction of the subcutaneous connective tissue. He adds that the acephalous monster is born frequently by the feet half an hour or three to twelve hours after the well-developed child. The hypertrophy of the trunk may render extraction necessary, and if this hypertrophy is very great make it exceedingly difficult; Mayer in such a case had to lessen the size of the trunk by the perforator. In hemicephalia or anencephalia there may be a large collection of serum in the ventricles, so that there is hydrocephalus. Difficulty in labor may come from the great development of the shoulders, especially if the head presents, for that is so small, unless enlarged as just mentioned, the way is not opened for the descent of the trunk. Delivery by podalic version is indicated; if version cannot be done, the hand may be applied to the head, or the finger introduced into the mouth, or the blunt hook used to make traction; if these means fail, the arms should be brought down.

Double Monsters.—A description of the different varieties of double monstrosities belongs to teratology. Playfair states that from an obstetrical view the following classification which includes those most frequently met with may be made:—

A. Two nearly separate bodies united in front, to a varying extent, by thorax or abdomen.

B. Two nearly separate bodies united back to back by the sacrum and the lower part of the spinal column.

C. Dicephalous monsters, the bodies being single below, but the heads separate.

D. The bodies separate below, but the heads partially united.

Veit rejects this classification, and proposes one containing ten varieties, presenting one or more illustrations of each. Hergott includes all double monstrosities in three classes according as connection of the fœtuses is by the head, by the trunk, or by the pelvis.

Double monstrosities occur four times more frequently in multiparæ than in primiparæ. The delivery in a very large proportion of cases is spontaneous, and in one-third of the cases the feet present; the fact that in many cases labor is premature explains the large proportion of unassisted deliveries.

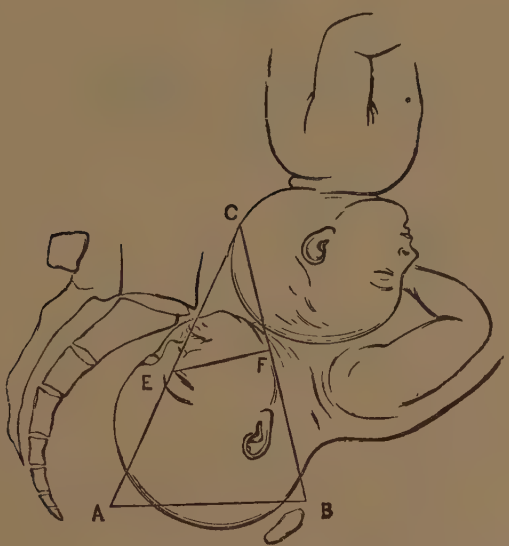
The diagnosis of monstrosities is impossible during pregnancy, and it is impossible, too, to know before the delivery the variety, therefore any classification with a view to guide in the treatment is useless. Charpentier thinks the conduct of the accoucheur is very simple. He must regard the life of the mother as of the first importance. Let nature do her work as far as possible, seek to ascertain the cause of the difficulty—this cannot be done in the majority of cases—and according to circumstances employ such means as he has at his dis-

position—hand or instruments—never forgetting the interest of the mother, and sacrificing the fœtus if necessary for her sake.

It may be necessary to lessen the volume of the fœtal mass by decapitation, embryotomy, or evisceration. Schonberg attempted separation of the fœtuses in the uterus. If the presentation be transverse, the feet should be brought down. In presentation of the heads Schroeder suggests that after the delivery of one the forceps be applied to the other head; when the feet are delivered first, he advises that equal traction should not be applied to them, but an effort be made to deliver the posterior infant first, so that its head may be brought low enough to rest upon the neck of the anterior infant, thus creating room for it, and preventing the heads from descending side by side in the pelvis. The Cæsarean section is forbidden by its danger to the mother, and by the fact that if the adhesions are extensive the fœtuses will not live, and if slight the labor can be terminated by other means.[1]

Dystocia in Plural Deliveries.—Interference of one fœtus with the delivery of the other is a rare complication of twin labors. Among the predisposing causes Besson[2] mentions the great size of the pelvis, the small size of the fœtuses, and their occupying a single sac; and among the determining causes the use of ergot, untimely rupture of a fœtal

FIG. 152.



SHOWS HEAD-LOCKING, BOTH CHILDREN PRESENTING HEAD FIRST.

sac, and other interferences with the natural course of labor. This interlocking of the fœtuses may occur in every one of the different varieties of presentations observed in labor with twins. Delay may occur from both heads presenting at the inlet, but this must be very rare, for Besson gives only one example. More frequently when the

1 Schroeder. 2 Dystocie Spécielle dans les Accouchements Multiples.

heads are first one descends into the pelvis slightly in advance of the other, then the latter is forced down so that usually the neck of the first child is pressed upon. In some cases the first head is delivered spontaneously or by forceps, and then it is impossible to effect delivery of the trunk, or the arrest in labor may come before this. The illustration, Fig. 152 (from Barnes), shows very well this form of interlocking.

In case the first infant presents by the pelvis and the second by the head, the body of the former is delivered, and then the labor stops from the two heads entering the pelvis, or coming to its inlet together. One form of this difficulty is presented in the accompanying illustration

FIG. 153.

SHOWS HEAD-LOCKING, FIRST CHILD COMING FEET FIRST; IMPACTION OF HEADS FROM WEDGING IN BRIM.—*D*. Apex of wedge. *E C*. Base of wedge which cannot enter brim. *A B*. Line of decapitation to decompose wedge and enable head of second child to pass.

(also from Barnes). In some cases the head of the second child is fixed upon the thorax of the first. When the heads are locked together this

may not be, as in the illustration, by the chins, but by the occiputs, or by a chin and occiput, or simply by the sides of the heads.

When the first child presents by the head, the second by the pelvis, the bag of waters of the former has descended so as to interfere with the transmission of the latter, and the labor been delayed until the obstetrician ruptured the obstacle. Besson quotes a case of this difficulty occurring in the practice of Mauriceau. When both fœtuses present by the pelvis, difficulties may occur from the simultaneous descent of the feet; and in one case of this kind, reported by Armand, the midwife exerted such powerful pulling that she brought away the trunk of each child, leaving the heads in the uterus. Schultze delivered a woman pregnant with twins, four feet and one hand presenting, by drawing upon the feet of the child which was lowest. Cazeaux gives a case from Pleissman, which was probably the first example in which difficult labor from the interlocking of fœtuses was treated by raising the woman's pelvis higher than her chest, a treatment which has within a few years been successfully resorted to by Galbraith[1]—the principle but not the plan used.

"Pleissman states that on one occasion he found the orifice plugged up by the parts that had become engaged, and which at first sight appeared to him to be a quantity of hands and feet. A more careful examination enabled him to distinguish four inferior extremities, which were delivered as far as the ham and one arm." "At first," he says, "I was in great perplexity because I could find no way of introducing my hand into the womb for the purpose of distinguishing and seizing the two feet belonging to each child, and because all my efforts to make even one of these extremities go back again proved abortive; besides which, in drawing on any two of them, I might confound them, and bring down the feet of two different fœtuses at the same time; and lastly, even if I succeeded in seizing the feet belonging to the same child, I might, by drawing upon them, engage the other parts, and thus augment the difficulties. Being greatly embarrassed as to the proper course, and yet obliged to act, the employment of a measure suggested by Hippocrates, under different circumstances, happily suggested itself; it was to suspend the patient by her feet, hoping that the heads and the bodies of the children would, by their weight, draw one or more of the extremities towards the fundus of the womb, which was still distended by the waters. The husband and brother-in-law of the woman passed their hands under her hams, and thus held her suspended, so that only the head and shoulders rested on the bolster. I intended, as soon as I mounted on the bed, to press back on one or more of the free extremities into the womb, but two had already returned from the mere position of the mother, and the other three followed by the aid of my fingers. Immediately afterwards, I was enabled to introduce my hand into the uterus, and to withdraw successively therefrom three children by the feet."

The first child may present by the head, and the second be transverse. Jacquemier has narrated the post-mortem condition found in a woman pregnant with twins who died undelivered; the head of the first fœtus was in the pelvic cavity, but the neck of the second

[1] American Practitioner, 1880, and American Journal of Obstetrics, 1882.

was below the shoulder of the first, and formed a half ring about its neck.[1]

The first child may present by the pelvis, and the second be transverse. Here the feet and trunk of the former may pass between the trunk of the latter, and then the head is arrested by the body which obstructs the inlet.

The last variety given by Besson is that in which the first child is transverse and the second presents by the pelvis. An illustrative case is quoted from Bartscher in which the feet of the second child were in the vagina, but the hand introduced into the vagina proved that the first was presenting by the shoulder, and the second was upon it *à cheval*, that is, a limb had descended upon each side of its body.

The treatment of dystocia from interlocking of twins is directed first to saving the mother, next to saving both, and if this cannot be done, to saving one of the twins. The first effort of the obstetrician should be to unlock the heads or other parts that cause the obstruction. This may be done in some cases by external and internal manipulations. Since Galbraith's[2] success certainly the knee-chest position should be tried. He was called to a case of labor with twins, first child with pelvic presentation, and delivered except the head, and it could not be extracted; the second child with vertex presentation. He had the patient take the knee-chest position while he supported the lifeless body of the partly delivered child. On introducing his hand he found the obstructing head quite movable, and readily pushed it out of the way; in a few minutes the head of the first child was brought down, and its delivery effected. If unlocking is impossible, and it may be in a case in which both heads present, the next step is to apply forceps to the head of the first child and endeavor to deliver it. Barnes advises to have an assistant during this effort apply his hand and push away the second head, but this supposes a very capacious pelvis and a mobile head. Tarnier advises if delivery cannot be effected by the forceps and the state of the mother requires action, especially if the child be dead, craniotomy. Decapitation of the first child has been practised by several obstetricians.

Reimann in his paper,[3] "Simultaneous Entrance of Both Heads of Twins into the Pelvis," mentions, among the number who have performed decapitation under these circumstances, Meigs, and Besson repeats[4] the statement. It may be a matter of no great consequence, but Meigs[5] said expressly that he never saw a case of the kind, afterward stating that one of his "brethren" in Philadelphia did meet with the difficulty "a few years since," and decapitated the first child when the second was easily delivered.

Reimann lays down the rule that in all cases "the forceps should be applied without delay to the second head; every other measure is unsuitable and useless." This statement seems too absolute.

Considering now those cases where the first child presents by the

[1] Manuel des Accouchements, tome ii. p. 131.
[2] Op. cit.
[3] American Journal of Obstetrics, 1877.
[4] Op. cit.
[5] Op. cit., 3d edition, p. 500.

pelvis and the second by the head (Fig. 153), Barnes states that the first child whose trunk is partly born encounters by far the greatest danger, and having discovered there is but a faint or no hope of saving attention should be turned to the best means of securing the second; the wedge may be decomposed by detaching the head of the first, or craniotomy be done. Decapitation of the first child, too, is advocated by Besson. Referring to the rule of most obstetricians to apply the forceps to the head of the second child, a rule which in this particular variety of locking of heads corresponds with that which Reinmann lays down for all cases, he says that it is irrational. Either the first child is living or it is dead. If it is dead, why not decapitate in order to facilitate the passage of the second, and lessen the pressure which the head of the other child and the soft parts of the mother are undergoing? If it is living, which is very improbable after the trunk has escaped, is there any chance of saving it? Craniotomy upon the second infant is to be rejected because that destroys a life which might be saved by other means. Reimann admits decapitation of the first child if the forceps applied to the second does not effect delivery, and if the latter shows distinct signs of life. Now in 34 cases collected by Besson where the first child presented by the pelvis and the second by the head, there were only 4 in which the former was born living, and therefore because the probabilities of life being saved are so small in the first, our efforts should be chiefly directed to saving that of the second child, and when the former presents an insuperable obstacle to the delivery of the latter, it should be got out of the way as soon as possible.

Mal-Presentation and Complex Presentation.—The child presents badly, that is, there is a mal-presentation, when some portion of it descends first, which offers such disproportion to the pelvic canal spontaneous delivery is impossible. The most frequent mal-presentations are those of the shoulder, that is, the child instead of being longitudinal in the uterus, and one or the other end of the fœtal ovoid being in the lower uterine segment, is in a position approximating a transverse line, and hence some portion of the side of the ovoid is in relation with the pelvic inlet; but as in the course of labor, one or the other shoulder ultimately takes this position at the inlet, the presentation is called by this name. In addition to shoulder presentations there may be, when the head comes first, a latero-flexion of the head upon the trunk, and hence the side of the head or of the face for a time present. Should this inclined lateral position of the head occur, nature, in almost all cases, rectifies the error, and the position becomes normal.

Dr. Hodge has narrated the case of a primipara, to whom he was called after she had been in labor five days, first under the care of a midwife, and then under that of physicians, and who had been given ergot freely; he found the superior strait "completely occupied by the head of the child, but an accurate diagnosis could not be made, owing to bloody tumors and infiltrations in the presenting part. The blades of the forceps were carefully passed on the sides of the pelvis to the superior strait, and, without difficulty, a firm grasp was made upon the child's head, which, however, was found perfectly immovable. Craniotomy being now determined on,

the head was punctured, the forceps, which had not been removed, were now used as compressors, their handles being approximated by means of a strong fillet; the head yielded to this compression, and even gradually brought down and delivered externally. It was now found that it had been originally a presentation of the right side of the head, and that one blade of forceps was over the face, and the other over the occiput; so that the long diameter of the head had been, by means of the forceps, so diminished as to allow the transit of the head through the outlet of the pelvis, with the face toward one ischium, and the occiput toward the opposite. The patient recovered without any special difficulty."

The case just narrated illustrates some of the evil effects of ergot; for had it not been given, the mal-presentation would almost certainly have been corrected by nature, and the labor probably terminated spontaneously with the birth of a living child. Nevertheless, in case the lateral inclination of the head persists, the indication is plain, as urged by Dr. Hodge, to rectify it by manual means; but in some cases, version or the forceps will be indicated with a final resort, as in the instance given by Dr. Hodge, to craniotomy.

The management of shoulder presentations will be considered in Obstetric Operations.

Complex or complicated presentations are those in which two or more unrelated parts of the fœtus, as, for example, the head and a foot or a hand descend. It is convenient also to consider, in this connection, prolapse of the cord, that is, a presentation of the cord with presentation of some part of the fœtal ovoid, for the same causes which usually produce prolapse of members are also in general those of similar mal-positions of the cord.

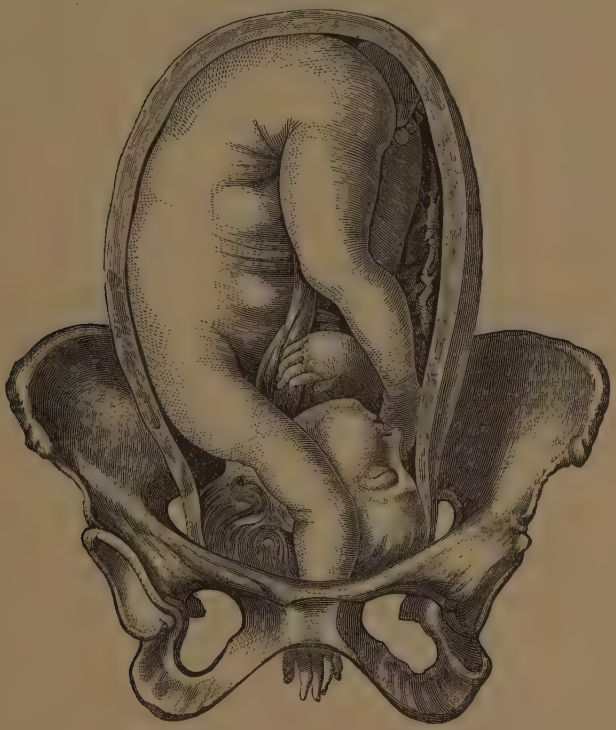
As an illustration of a complex presentation the following case from La Motte[1] is of interest. On the 27th of October, 1711, he was called to the wife of a carpenter, at Montebourg, who had been in labor since the preceding day, and whose child occupied such a position that the *sage-femme* could not explain it. He found the woman very much exhausted, and, upon touching, he distinguished two hands, the head, a foot, and the cord, the last being cold and without pulsation. He introduced his hand, pushing the head away, and carried it to the fundus of the uterus, where he found the second foot, which he drew into the passage, in order to have the two feet together; as he drew the feet out the arm ascended, thus leaving the passage free, and in fifteen minutes the woman was delivered.

Frequency and Causes of Prolapse of Members.—Depaul found in 16,613 labors, 163 where there was prolapse of the members alone or with the umbilical cord; the proportion is then 1 to 102. The upper limbs more frequently prolapse than the lower. In some cases a hand or the arm may descend by the side of the head; in others a hand is on each side of the head, or a hand or arm descends with the pelvis. These complex presentations occur more frequently when the vertex or face, rather than the pelvis, presents. In some cases a foot has descended with the shoulder, but the descent of a hand or arm when

[1] Observation CCXCII.

the shoulder presents does not complicate the presentation any more than the descent of a foot complicates that of the pelvis, since in each case the prolapsed member belongs to the part with which it descends.

FIG. 154.



HAND PROLAPSED BY THE SIDE OF THE HEAD.

Madame Lachapelle and all authors who have written upon the subject since, said Depaul, have admitted as predisposing or occasional causes the small size of the fœtus, the abundance of the amniotic liquor, its rapid discharge, oblique presentation of the fœtus, when, for example, instead of being directed in the middle of the superior strait it is rather directed obliquely toward one of the sides of the circumference of the strait, and, finally, vices of conformation of the pelvis. Charpentier gives in addition rupture of the membranes when the woman is standing, and unskilful or untimely attempts to perform version.

Diagnosis.—We have not only to recognize the fact that the presentation is complicated, but also the cause of the complication, in other words, know that a member has prolapsed, and what that member is. The diagnosis before rupture of the membranes is usually difficult, and may be impossible. Possibly a member may be found near the head, and then the former may be pressed against the latter, so that an examination will determine whether it is a hand or foot. In case

the head or other presenting part of the fœtus is too high for this to be done, Depaul suggests pressing the member against the pelvic wall, and thus fixing it momentarily for examination. Of course the probabilities are that a member found near the head is a hand. After the rupture of the membranes the diagnosis is generally easy. Sometimes[1] it is a hand that is applied upon one of the sides of the head in front or behind, but almost always resting upon one of the parietal bones, and in others it descends lower than the head, and is then readily distinguished. The forearm may be upon the side of the head as if the child were resting on it. If the pelvis presents, of course we know that the prolapsed member must be a hand. In some cases this has descended into the vagina and even projects from the vulva; then there is no difficulty in recognizing what this member is, but there may be in deciding with what presentation it is associated, for it is not uncommon at once to conclude from the hand being in this position that there is a shoulder presentation, but to avoid error the practitioner should always follow up the member until he reaches the presenting part. So, too, if a foot be found in the vagina the conclusion that the pelvis presents is not a necessary one, for the former may have descended by the side of some other presenting part. A foot seldom descends low in the vagina, and being larger delays the descent of the presenting part much more than a hand does.

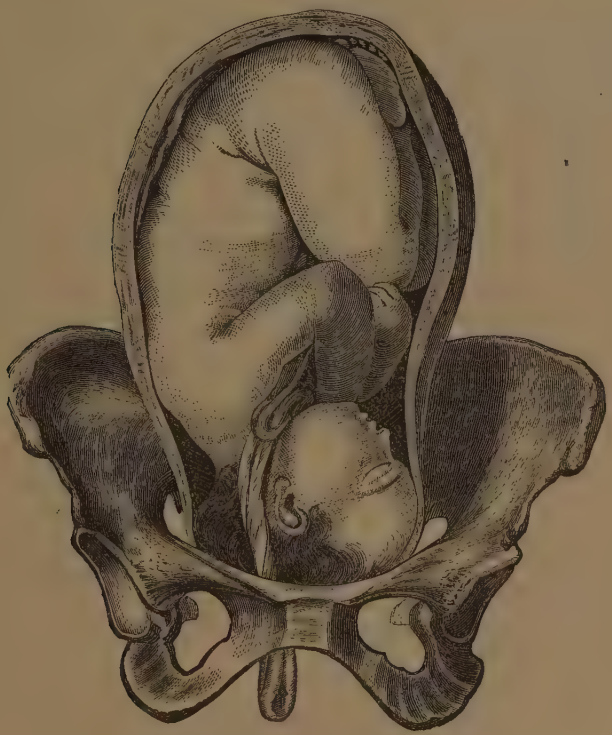
Treatment.—In very many cases when a hand or foot is at the side of the fœtal head before the rupture of the waters it is, as it were, pushed up by the descending head, or at least the former is crowded out of the pelvic inlet by the entrance of the latter. Or again, if the prolapse be slight, and space be sufficient, the head comes down, bringing the prolapsed member with it. If descent of one or more members be ascertained before the rupture of the membranes, the patient should lie down, and other precautions be taken to preserve them entire until the os uteri is completely dilated. If the prolapsed member interferes with the entrance of the head into the pelvis, it should be replaced by the hand introduced into the vagina, after which it may be advisable to use forceps, or if the contractions are vigorous it is possible that the entrance of the head into the pelvis, when the obstruction is pushed aside, takes place readily, and its rapid descent will render artificial delivery unnecessary. So, too, in some cases, especially in one like La Motte's, podalic version is indicated. Should reduction of a prolapsed member or members fail while the patient is recumbent, an attempt may be made when she is in the knee-chest position.

Presentation and Prolapse of the Umbilical Cord.—When the cord towards the end of pregnancy is in the vicinity of the os uteri, or descends at the beginning of labor, or only during the period of dilatation, between the presenting part and the membranes, there is said to be a presentation of the cord; the term prolapse is applied to the descent occurring at the rupture of the membranes, the prolapse being complete if the cord protrudes from, but incomplete if remaining within, the vagina.

[1] Depaul.

Frequency and Causes.—Churchill's statistics show that prolapse of the cord occurred in British, French, and German practice once in

FIG. 155.



THE FUNIS PROLAPSED BY THE SIDE OF THE HEAD.

231½ cases. In the Dublin Lying-in Hospital, in 50,061 cases it happened 304 times, or 1 in 168. Charpentier gives the proportion of 1 in 227.

Naegele, in explaining the accident, attributed great importance to the lower uterine segment not being completely occupied by the fœtal part; if this application be perfect the cord is retained in the womb by the same cause which prevents the flow of all the amniotic liquor, and only that which is between the head and membrane is discharged. The accident is more frequent in multiparæ than in primiparæ, because in the latter the head completely fills the lower portion of the uterus, and engagement occurs some time before labor begins. Among other causes usually given, are excess of the amniotic liquor, premature rupture of the sac, smallness of the fœtus, face, shoulder, and pelvic presentations, multiparity,[1] great length and weight of the cord, its mar-

[1] The statistics of Engelmann, however, show that "prolapse of the cord is almost as frequent an accident in the strong, rigid uterus of the primiparæ as in the more yielding womb of the multiparæ." See American Journal of Obstetrics, vols. vi. and vii., for an elaborate article upon *Prolapse of the Umbilical Cord.*

ginal attachment, the placenta being situated in the lower portion of the uterus, oblique position of the uterus, pelvic deformity, and prolapse of one of the fœtal members.

Diagnosis.—The recognition of the cord being by the side of the presenting part may be difficult in the early stage of dilatation when the membranes are entire; if the cord can be readily touched during the interval of a uterine contraction, its characteristics may usually be determined; it has not the size, shape, or consistence of foot or hand, and besides it is not suddenly withdrawn as a member often is when touched; possibly by pressing it against a resisting part pulsation may be recognized.

After the rupture of the membranes if the cord has escaped from the os uteri, diagnosis is easy, especially if the pulsations can be felt.

The absence of pulsation in the cord does not necessarily indicate that the fœtus is dead, for it may be only temporary; Charpentier delivered a living child by podalic version ten minutes after no beating in the cord could be felt. On the other hand, as observed by Naegele, very often the pressure need be for only a few minutes to kill the fœtus. It is better, in a doubtful case, to listen for the sounds of the fœtal heart.

Prognosis.—The accident does not affect the mother, but is very dangerous to the child. Engelmann states that of 365 cases of prolapse 171 of the children, 47.7 per cent., were saved; in foot presentations, 71 per cent. of the children were saved; in pelvic, 40, and in vertex, 36.7. Hecker had a mortality of 43 per cent. in head presentations, and in pelvic 17 per cent.; including all cases the mortality was 37.6 per cent. The statistics of Scanzoni gave a mortality of 55 per cent., and those of Churchill 53 per cent.

Treatment.—Formerly it was thought the chief danger to the child occurred from the cord becoming cold in case of complete prolapse—Velpeau, indeed, attributed the danger partly to this—and hence they were careful to restore it to the vagina, or to have it wrapped in warm cloths. Some have held that the arteries only were compressed, and hence the danger was from plethora, while others thought the compression affected the vein exclusively, and therefore the child was anæmic. But partial compression is rendered impossible by the arrangement of the vessels. It is easy to understand that compression of the umbilical cord in suppressing hæmatosis causes asphyxia in the same manner as during extra-uterine life; suffocation, strangulation, or pulmonary embolism determines death in suppressing respiration.[1]

Recognizing the cause of death we endeavor to avert it by preventing pressure upon the cord. If presentation of the cord be recognized in the first stage of labor the woman should be lying down, and great care should be taken to preserve the bag of waters unruptured until this stage is completed.

After the rupture of the membranes if the cord prolapses in front of the child's head, and thus the life of the fœtus be endangered by pressure upon it, the advice given by Smellie still remains the best. He said, "If the navel-string comes down by the child's head, and the

[1] Depaul.

pulsation is felt in the arteries, there is a necessity for turning without loss of time; for, unless the head advances first and the delivery is quick, the circulation in the vessels will be entirely obstructed, and the child consequently perish. If the head is low in the pelvis, the forceps may be successfully used."[1] McClintock, in a note upon this passage, has stated that of all the modes of treatment recommended, the most successful, as regards the child, is turning. "Thus of sixty-four cases, in the practice of La Motte, Mauriceau, Lachapelle, Boivin, Giffard, and McClintock, when turning was resorted to solely on account of the funis presenting, fifty-two of the children were born alive."

It happens in some cases that after the membranes have ruptured, and the cord prolapses so as to be subjected to pressure, the head is expelled so rapidly there is no necessity for applying forceps, the cord being compressed for so short a time that there is no risk to the child. Turning prior to the rupture of the membranes is not indicated if the cord presents, for we do not know that after the discharge of the amniotic liquor it will certainly prolapse so as to probably suffer compression.

Replacement of the Cord.—Neither turning nor the forceps being employed, we may endeavor to partially at least protect the cord from pressure by putting it in that part of the pelvis where the most room is found, and that will be opposite one or the other sacro-iliac joints according to the position of the head. But it is better in most cases to replace the cord, and this reposition may be manual, instrumental, or postural. Mauriceau directed that an effort should be made to carry the cord by the fingers of one hand behind the head, and keep it there until the latter had descended so as to prevent its prolapsing again; he added that a compress might be placed between the head and the uterus to sustain the cord after it was replaced. For Mauriceau's compress other obstetricians substituted a sponge, and still others sought to put the cord around one of the fœtal members. Dr. William Harris, of Philadelphia, in a presentation of the breech, returned the cord over the knee, and the child was saved.[2] Boër thought so unfavorably of manual reposition, because of the fact that generally the cord prolapsed again and again after repeated replacement, that he compared it to the task of the Danaïdes.[3]

In consequence of the liability to prolapse again after manual replacement, various repositors, that not only are designed to facilitate the replacement but also to prevent the recurrence of the accident, have been devised. A simple and long known method is to attach a piece of whalebone, or an elastic bougie or catheter, to a small bag or purse, into which the cord may be placed, and then be restored. As soon as the head descends, the whalebone or bougie may be safely withdrawn.[4] A repositor may be improvised of an ordinary rubber catheter and stylet, with a piece of tape or string. A loop of the tape or string is passed into the eye of the catheter, and the stylet then introduced so

[1] Op. cit.

[2] Hodges, op. cit.

[3] Depaul used the same apt comparison. A recent able and distinguished writer deserts the Danaïdes and seeks Sisyphus. No one has yet called upon Hercules, or upon Briareus.

[4] Hodge.

that it holds the loop; the cord is fastened by the free ends of the tape, and by the catheter carried into the uterus as far as desirable, and the stylet withdrawn. Charpentier speaks favorably of the following method used by him successfully in one case: "The cord is encircled by a loop of silk, and the ends tied so that the cord will be firmly held but not compressed; the ends are now firmly fastened around the end of an olive-shaped elastic or wax bougie; the cord is now carried within the uterus until the lower end of the bougie is at the os. The bougie is left in the uterus, there is no tendency to recurrence of the prolapse, and the instrument excites uterine contractions, and thus hastens, which is always desirable, the termination of the labor."

Nearly two hundred years ago a famous Holland obstetrician, Deventer, advised the position on the knees and elbows in the treatment of prolapse of the umbilical cord: "The advantages of this position have been shown in later years, especially by Ritgen, Kiestra, Thomas, and Theopold."[1] Playfair states that the success of this manœuvre is sometimes very great, but by no means always so, and that it is most likely to succeed when the membranes are unruptured. This position, if maintained for some time, is quite wearisome, and certainly causes the uterine force to act at a great disadvantage. Deventer also advised a lateral position in the treatment of prolapse of the cord; and Galabin states that if the patient cannot be readily induced to adopt the knee-elbow position, the semi-prone position may be used from the first with almost as much advantage.

Even when the pulsations in the cord are feeble and separated by long intervals, hope of saving the child should not be abandoned; the less near the end of pregnancy the longer the child survives interference with the circulation. But when no pulsation has been discovered for fifteen minutes, examinations being made in the intervals of contractions, it may be concluded the fœtus is dead, and the delivery conducted without reference to its interests.

[1] Schroeder.

CHAPTER VII.

ANOMALIES OF THE PELVIS.

[This chapter is contributed by Dr. HENRY MORRIS, Demonstrator of Obstetrics, Jefferson Medical College.]

Definition.—It has been said that since the world began no two women have had pelves which exactly resembled each other in every particular; that in each case there has been some difference, more or less minute, by which any pelvis can be distinguished from all others. While this is probably an exaggeration, it is nevertheless true that the female pelvis is subject to many variations, both as regards its size and its shape. The "normal pelvis," therefore, is more of an ideal than of a reality—a pelvis conceived from the "good points" of many pelves, whose diameters are arrived at from averages derived from the measurements of thousands of specimens. The term "anomalies of the pelvis," then, does not refer to any slight variation from this perfect type, but to such changes in configuration or measurements—whether the result of disease or of arrested or of vicious development—as will present an obstacle, more or less insurmountable, to the passage of the products of conception, or otherwise modify the act of parturition.

Importance and Increasing Frequency.—While it is not common to find American-born white women with pelves sufficiently deformed to offer serious obstruction to the passage of the child during labor, yet the constant stream of immigration, consisting in many instances of families who have been subjected to hard usage, and have lived under the worst possible hygienic conditions in their former homes—circumstances which, as will be seen, are powerful factors in the production of pelvic anomalies—has caused such deformities to be more frequently observed, and more carefully studied in this country of late years. In proof of this may be adduced the increasing space devoted and prominence afforded to the consideration of this subject in American text-books on obstetrics, the greater number of cases which are now reported in our journals, and papers read on the subject before our societies. As the country becomes more crowded, the conditions which produce these anomalies in other and older countries will probably act here also, and it is hardly to be hoped that the immunity at present enjoyed by American-born white women will continue to exist.

As regards anomalies of a lesser type, such as retard the second stage of labor without presenting a serious obstacle to the birth of the child, they probably exist more frequently than is generally supposed, and are overlooked by the medical attendant; indeed, many cases of

tedious labor, as well as many cases of mal-presentation, may be fairly attributed to this cause. As Lusk[1] has said: "It is impossible to study the cases of vesico-vaginal fistulæ, reported by Dr. T. A. Emmet, without arriving at the conclusion that the existence of contracted pelvis is frequently overlooked." On account, then, of the increasing frequency of these conditions, it is necessary to study closely their *varieties, causation and mode of production, diagnosis and treatment.*

Varieties.—Anomalies of the pelvis have been variously classified by different writers, according to the *shape* of the pelvic inlet and outlet; according to the supposed *cause;* or according to the *diameters of the pelvis which are principally encroached upon* by the abnormality.

Madam Lachapelle describes abnormal pelves under the various tities of *reneform, triangular, rounded, oval, bilobed, cordiform,* etc., according to the shape of the inlet and outlet. This classification has the effect of multiplying the varieties indefinitely, and, as she admits, leaves many varieties of these various orders yet undescribed.

The classification according to *cause,* while apparently the best on account of its simplicity, is objectionable, because in certain cases the cause is yet *sub judice,* as in the case of Naegele's pelvis (obliqua ovata), while in other instances the same cause may produce totally different effects, according to circumstances; thus, rachitis, which usually gives rise to narrowing of the antero-posterior diameter of the inlet, may under other conditions produce deformities involving all of its diameters. The best classification, therefore, is that based upon the *situation* of the obstruction and the diameter with which it interferes, for when attending a parturient woman whose pelvis presents an obstacle to the descent of the child, the obstetrician is more desirous of knowing the situation of the obstruction than naming its cause; hence this classification appears the most natural as well as the most practical.

A. *Anomalies involving the Entire Pelvis.*—The pelvis itself may be perfect in shape, the diameters may bear the normal relation to each other, and yet, by deviating from the normal size, it may be an exceedingly bad one for purposes of parturition.

I. *Pelvis Æquabiliter Justo-Major.*—In this abnormality, which is not very uncommon, the pelvis is equally enlarged in all its diameters, which still preserve the normal relation to each other. The result is simply a pelvis larger and more roomy than the normal. This variety of pelvis, although most commonly found in large, well-developed women with wide hips, is by no means confined to them, as it has frequently been seen in *petite* women also. It appears to be hereditary, as the women of some families seem always to have rapid labors and to be subject to the accidents enumerated below. It would be imagined at first thought that this would be a pelvis highly favorable for easy parturition, and perhaps as a rule this is the case, but its very spaciousness constitutes an objection, as from the large size of the cavity, the uterus does not rise up as it should about the third month of gestation, thus deranging the circulation of the parts, causing hemorrhoids, etc., and by pressure interfering with the function of the bladder and

[1] Science and Art of Midwifery, 1885, p. 462.

rectum. It is also said that the gravid uterus is much more apt to be retroverted in a pelvis of this character. Again the pelvic inlet is so large that the inferior segment of the uterus toward the end of pregnancy presses constantly down into the cavity of the pelvis, giving rise to rectal and vesical tenesmus, and sometimes preventing entirely the passage of urine by pressing on the urethra.[1] Obliquity of the uterus is more commonly seen as a concomitant to pregnancy in women with this anomaly, because the false pelvis is so large that the corpus uteri frequently falls toward one side or the other as it rests on the iliac fossa. During labor, also, the large size of the inlet, by not affording support to the head and inferior segment, allow them to pass down into the cavity before dilatation of the cervix is complete. Indeed, it is said that the uterus, not being supported below, may be torn from its attachment, or the lower segment from the body of the uterus, by the force of the abdominal contractions before dilatation is sufficiently advanced for the passage of the head; and that lacerations of the cervix are more frequent in these cases of large pelvis. If the child is of small or normal size and the contractions of the uterus of normal intensity the labor is always rapid, and the presenting part not meeting with much resistance is driven down against the pelvic floor before it has had time to become distended, and a rupture of the perineum is the consequence. Nor does the evil end with parturition, as the enlarged uterus, instead of ascending into the abdominal cavity, may remain in the cavity of the pelvis, and, the process of involution being checked by the derangement to the venous circulation consequent upon its position, subinvolution, or various displacements may result.

II. *Pelvis Æquabiliter Justo-Minor.*—This condition is the reverse of that which has just been considered, for in it, the pelvis which is normal in shape, is diminished in size, equally in all directions; its diameters, which bear almost the normal relation to each other, being decreased nearly proportionately. Two varieties of justo-minor pelvis are usually mentioned: (1) Those occurring in well-formed women, of any height, where nothing about them either as regards shape, size, or carriage lead to the suspicion of pelvic contraction; and (2) those occurring in dwarfs.

1. Of the first variety, Naegele says, the pelvis, with respect to the thickness, strength, texture, and indeed all the physical characters of the bones, size excepted, does not differ from a normal one. Litzmann,[2] however, has called attention to certain differences in the relations of the various parts which are not found in the normal pelvis. Thus the sacrum is diminished in width, the alæ particularly being small; there is less pronounced forward rotation of the promontory and less curving of the lower extremity of the sacrum; the concavity

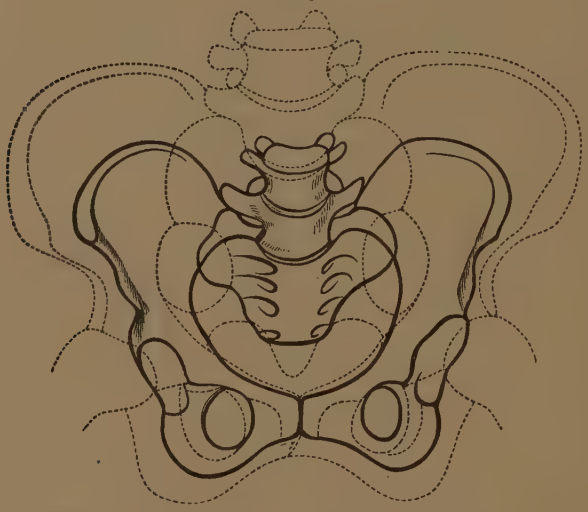
[1] The writer attended a case of this kind in a young primipara, where the os uteri was felt resting on the perineal floor in the eighth month of pregnancy, and the pressure on the urethra was so great that the passage of a flexible catheter was impossible until the head contained in the lower segment of the uterus was pushed up. Catheterization had to be performed daily for two weeks prior to confinement.

[2] Litzmann, "Die Formen des Beckens," Berlin, p. 40.

of the sacrum in a transverse direction is increased; the posterior sacral surface is nearly on a level with the posterior superior spinous processes, instead of sinking forward between the ilia; the height of the anterior and lateral walls is proportionately lessened; and the angle formed by the symphysis pubis with the antero-posterior diameter is often increased. In spite of these differences the pelvis may be said to be of the feminine type.

The subjoined figure (Fig. 156), taken from "Holmes's System of Surgery," represents the normal pelvis in dotted outline, and a small

FIG. 156.



JUSTO-MINOR AND NORMAL PELVIS COMPARED.

pelvis in bold outline, for sake of comparison. Both are drawn to the same scale. The latter was drawn from the pelvis of a woman who died a few days after a labor terminated by embryotomy. These pelves are evidently due to a premature arrest in growth, often occasioned by some disturbance of nutrition, occurring frequently in early life, as scrofula, rickets, and other diseases which tend to retard or suspend the growth of bone.[1] In some cases this defect appears to be hereditary, while in others no cause can be assigned for the small size of the pelvis. This anomaly of form is rare, but is more common than the variety now to be considered.

2. The pelves of the second variety, that occurring in dwarfs, are not only small, but usually resemble the pelves of young girls at the age of puberty, both in configuration and in the mode of union of the different segments by cartilage. In these instances there has been not only an arrest of bone growth, but also of development, preventing the pelvis from attaining to the condition of maturity.

Where all the diameters are contracted equally, the obstacle pre-

[1] Cf. Holmes's System of Surgery, Am. ed., vol. iii. p. 896 *et seq.*

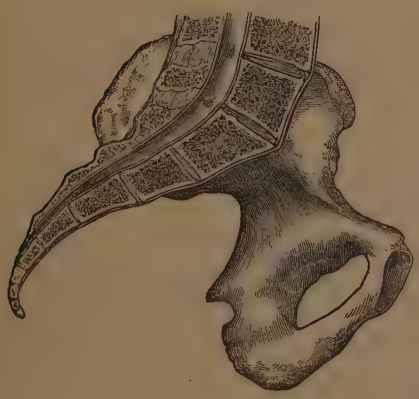
sented to the passage of the fœtus will of course be greater than if only one diameter is lessened, as, obviously, compensatory moulding cannot take place; hence the pelvis justo-minor when small is one of the worst anomalies met with by the obstetrician.

B. *Anomalies affecting principally the True Pelvis.*—From a glance at the normal pelvis it will be seen, that while the ilium enters into the formation of the false pelvis and the inlet, together with a small portion of the lateral wall of the cavity; and the ischium, the cavity, and outlet, the pubis aids in completing both the inlet, the cavity, and outlet; hence a deformity of the latter bone would probably lead to a variation in the diameters of all three of the component parts of the true pelvis, while deformities of the ilium or ischium would affect chiefly the inlet, and the cavity and outlet respectively. A malposition or malformation of the sacrum, on the other hand, might result in a variation in the measurements of either the inlet or cavity, or if the lower portion of the bone projected markedly forward, the antero-posterior diameter of the outlet might also be diminished, as this measurement during labor is taken from the apex of the sacrum to the under surface of the centre of the sub-pubic ligament.

I. *Anomalies decreasing the Antero-posterior Diameters.*—Several varieties of this class are recognized. They constitute by far the most common anomalies met with by the obstetrician.

1. The sacrum may approach the pelvis, sinking downward between the ilia, thus lessening not only the antero-posterior diameter of the inlet, but that also of the cavity, and frequently that of the outlet. The transverse diameters are generally somewhat increased. According to Lusk[1] the antero-posterior diameter is rarely less than three

FIG. 157.



FLATTENING OF THE SACRUM.

FIG. 158.

EXAGGERATED SACRAL CURVATURE.

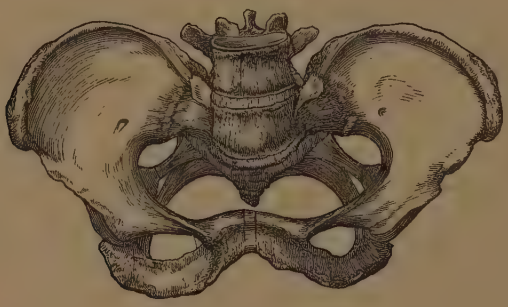
inches, but the whole pelvis is usually of small size. This anomaly is not connected with rickets, but is supposed to be due to pressure while

[1] Op. cit.

the bones were yet soft in childhood, and has been ascribed to the habit, prevalent in some places, of carrying weights on the head.

2. *Rachitic Pelvis.*—The sacro-vertebral angle approaches the pubis, having sunk forward and inward between the ilia, thus narrowing the conjugata vera; the anterior face of the sacrum may be flattened, or more concave than normal, but as the upper portion is rocked forward between ilia, the dimensions of the cavity and outlet are usually normal or increased, although in some cases the outlet will also be narrowed. Sometimes the antero-posterior diameter is further de-

FIG. 159.



RACHITIC PELVIS.

creased by flattening or even bending inward of the pubic symphysis, the latter constituting what is known as the "figure-of-eight deformity." (Fig. 161.) This antero-posterior impression causes compensatory

FIG. 160.

FIGURE-OF-EIGHT PELVIS, SEEN FROM ABOVE.

increase of the transverse diameters. The flattening of the pubis brings the acetabula more toward the front. The false pelvis is also anomalous, for the ilia are flattened, and the anterior superior spines flare outwards, so as to form almost the widest part of the crest. Other deformities due to rickets will be spoken of hereafter in their proper place.

3. Certain *affections of the lower part of the spinal column* may cause narrowing of the conjugate diameter: thus, (*a*) *Spondylolisthesis* (σπόνδῦλος, "a vertebra," and ὄλισθησις, "a slipping and falling"), a rare disease, which consists in such a change in the relations normally existing between the upper surface of the first segment of the sacrum and the lower surface of the body of the last lumbar vertebra, that the latter with the lower portion of the spinal column gradually slides

down into the cavity of the pelvis, which is tilted upwards and backwards, and diminishes markedly the "useful" antero-posterior diameter of the inlet, which it partially fills, although the true conjugate or sacro-pubic diameter is really increased, because the base of the sacrum is forced backward between the posterior superior iliac spines which are pressed apart. The lower surface of the last lumbar vertebra rests against the anterior surface of the sacrum, and its anterior surface looks more or less directly downward, while those of the second, third, and fourth lumbar vertebræ form an arch, the convexity of which is directed toward the pubis, thus substituting a lumbo-pubic for a sacro-pubic diameter. The apex of the sacrum is pressed forward and thus the antero-posterior diameter of the outlet is also decreased. The transverse diameters are also lessened progressively from above downwards on account principally of the outward displacement of the posterior and upper parts of the ilia. From the investigations of Neugebauer it would appear that spondylolisthesis is generally due to defective ossification between the body and arch of the last lumbar vertebra, allowing the body to glide downward gradually over the anterior surface of the sacrum, as already mentioned, until it is arrested by a process of bony union with the latter. As the arch remains *in situ*, it is easy to understand how the spinal cord escapes compression.

FIG. 161.

SPONDYLOLISTHETIC PELVIS. (Kilian.)

(*b*) *Lordosis* (λόρδωσις from λορδόω, "to bend forwards and inwards"), anterior curvature of the spinal column, when occurring in the lumbar region, especially if combined with rotation "forward of the upper part of the sacrum, as in the rachitic pelvis," may diminish the conjugata vera. In the latter cases it simply aggravates the already existing deformity.

II. *Anomalies involving the oblique diameters*, though not as common as those of the antero-posterior, are more frequently seen than those of the transverse diameters.

1. *The Osteo-Malacic Pelvis.*—In this variety of pelvis the distortion is such that the transverse as well as the oblique diameters are lessened, while the conjugata vera is much increased, although, as will be presently seen, the anterior portion of it is usually unfit for obstetrical purposes. The ossa innominata are bent inward toward each other anteriorly, so that the symphysis pubis forms a projecting and often angular beak; the so-called "horizontal" rami of the pubes as well as the ischio-pubic rami are approximated and more or less nearly parallel, thus diminishing the pubic arch; the ilio-pectineal line runs forward and outward anteriorly, so as to resemble in its curve the old-fashioned italic *ſ* tilted backward; the cavity of the pelvis is encroached upon by a prominence corresponding to the bottom of the acetabulum, and the

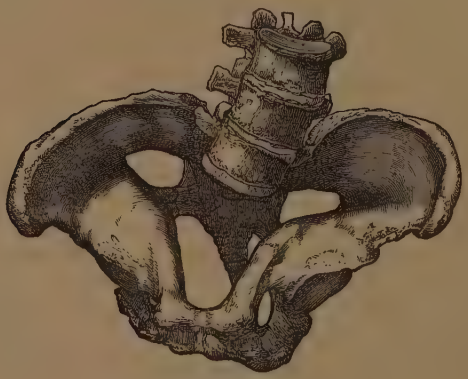
tuberosities of the ischia approach each other in such a way that the transverse diameters of the pelvis diminish from above downwards. The iliac crests are sharply curved so that their anterior superior spines approach each other, and the whole ilium is more vertical than

FIG. 162.

OSTEO-MALACIC PELVIS.

normal. The sacrum also shares in the deformity, as it is narrowed usually, and bent upon itself so that the apex, which is often strongly curved upward and forward, approaches the sacro-vertebral angle which is itself bent downward and forward as if to meet it. In addition to all this the whole sacrum is often displaced downwards. Thus the sacro-pubic diameter, although often much greater than normal, is for all practical purposes often useless, as in well-marked cases the

FIG. 163.



PSEUDO-OSTEOMALACIC PELVIS.

anterior portion, that included between the almost parallel pubic rami, is so narrow that were it not for the pliability of these pelves (*vide* p. 489)

it might be omitted from the consideration of the birth canal in these cases. The coccy-pubic diameter is much encroached upon also by the bending forward and upward of the apex of the sacrum, and as the transverse diameter is markedly lessened and the pubic arch narrowed, it will be seen that the outlet is as much if not more deformed than the inlet.

2. *Psuedo-Osteo-Malacic Pelvis.*—Sometimes a pelvis deformed by rickets assumes a shape resembling that caused by osteo-malacia. In these instances the antero-lateral walls are pressed inwards, upwards, and backwards, and as the sacro-vertebral angle, projected far forward toward the pubis, and the symphysis form a beak in front of the rami which are very nearly parallel, the plane of the inlet resembles a triangle. The characters of the rachitic pelvis are generally sufficiently marked to render its recognition easy.

3. *The Naegele or Oblique Ovate Pelvis*, derives its name from Naegele, who was the first to devote special study to its etiology and

FIG. 164.

OBLIQUE OVAL PELVIS.

mode of production. According to his description[1] it is characterized by the following peculiarities:—

(1) Complete anchylosis of one sacro-iliac joint, or a "perfect fusion" between the sacrum and one of the iliac bones.

(2) The development of the lateral half of the sacrum has either been arrested or is imperfect, and the anterior sacral foramina are of small size on the anchylosed side.

(3) Diminished breadth and consequently a diminished extent of the sacro-sciatic notches on the deformed side. What would be the articular surface if the bones were not "fused" is shorter than that on the normal side.

(4) The sacrum is distorted toward the fused side, toward which also its anterior surface is turned, while the symphysis pubis is pushed toward the normal side, and of course is not directly in front of the sacro-vertebral angle.

[1] Naegele, "Das schrägverengtes Becken," Mainz, 1850, p. 7.

(5) The os innominatum of the deformed side is so flattened internally that the *linea ilio-pectinea* is almost a straight line.

(6) On account of the great deformity of the one side, the other must necessarily be somewhat distorted, hence the *linea ilio-pectinea* is "more curved in its posterior, and less so in its anterior half, than in a normal pelvis."

(7) The results of these deformities are:—

(*a*) That the pelvis is contracted in that oblique diameter, measured from the normal sacro-iliac joint to the opposite ilio-pectineal eminence, while the other oblique diameter "is not at all diminished, but may even be larger than usual, when the obliquity of the pelvis is greater."

(*b*) That the distances from the sacro-vertebral angle to the ilio-pectineal eminences, as well as that from the apex of this bone to the spines of the ischia would be less on the side where the anchylosis exists.

(*c*) That the distance from the tuberosity of the ischium on the anchylosed side, to the posterior superior spine of the opposite ilium, as also that between the spine of the last lumbar vertebra and the anterior superior spine of the ilium on the anchylosed side, are smaller than the same measurements on the opposite side.

(*d*) That the distance from the lower border of the symphysis pubis to the posterior superior spine of the ilium is greater on the anchylosed than on the normal side.

(*e*) That the walls of the pelvic cavity converge somewhat obliquely from above downwards, thus narrowing the pubic arch which consequently approaches more nearly to the male type.

(*f*) That the acetabulum on the flattened side is directed much more toward the front than normal, while the opposite one is turned almost directly outwards.

In addition, as regards the diameters of the inlet, it may be stated that while one oblique is diminished and the other increased, as has been mentioned above, the antero-posterior is somewhat increased and the transverse is lessened, not at the inlet only, but throughout the whole pelvis, thus becoming progressively shorter from above downwards.

The cause of this deformity was attributed by Naegele—and in this view he has many followers—to anchylosis of the sacro-iliac joint preventing development. As, however, anchylosis of the joint has been found without oblique deformity, and oblique deformity without coexisting anchylosis, other causes must aid in its production. When oblique ovate pelvis occurs without anchylosis the above description will apply, with the exception, of course, that in the latter both sacro-iliac articulations are normal as regards structure.

4. *Certain affections of the lower part of the spinal column* also diminish the oblique diameter of the inlet. (*a*) *Scoliosis* (σκολιός, "crooked," and ὄσις, "a thrusting"). Lateral curvature of the spine, when occurring in the lumbar as compensatory to a similar condition in the dorsal region, especially if superadded, as is often the case, to a "rickety pelvis," greatly diminishes the antero-posterior, as well as the oblique diameter of the inlet. The sacro-vertebral angle is tilted over and

approaches the ilio-pectineal eminence corresponding to the side of curvature, while the ilium is pushed upward, backward, and inward, by the increased pressure upon the distorted side of the pelvis, owing to the body-weight being chiefly sustained by the limb of that side. From the altered position of the ilium, the pubic symphysis is naturally displaced toward the unaffected side, and, as a consequence, is not opposite the centre of the sacro-vertebral angle. The whole pelvis is thus asymetrical; the oblique diameter of the affected side is greater than its fellow, but owing to the approximation of the sacro-vertebral angle to the ilio-pectineal spine, it is useless for obstetrical purposes. At the outlet the coccy-pubic diameter is also lessened, but not in proportion to the diminution of the conjugata vera.

The causes of scoliosis in this region are the same as those producing lateral curvature in other portions of the spine. It is often compensatory to a curvature in the dorsal region.

5. *Affections of the lower extremity of one side* may cause an obliquity of the pelvis, similar to that already described as the Naegele pelvis, with the exception that no anchylosis or fusing of the bones is present at the sacro-iliac articulation. Thus: (*a*) *Congenital dislocation* of the hip-joint; (*b*) *amputation of the lower extremity;* and (*c*) *hip-joint* disease, occurring on one side only, may produce obliquity of the *opposite* side; while (*d*) *shortening of the lower extremity* often causes obliquity of the *same* side of the pelvis. These deformities are to be ascribed to pressure, and will be again alluded to.

III. *Anomalies involving the Transverse Diameters.*—Narrowing of the transverse diameter of the inlet is much more rarely seen than contraction of the antero-posterior or oblique diameters, but, on the other hand, at the outlet it is one of the commonest deformities, and its occurrence in several of the abnormalities already discussed has been previously alluded to.

Fig. 165.

Robert's Pelvis. (Lambl.)

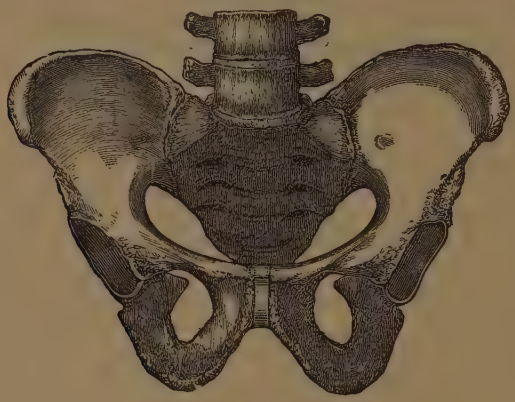
1. *Robert's Pelvis* owes its name to Robert of Coblentz, who first described it (1842). It is a very uncommon deformity, and consists in anchylosis of both sacro-iliac joints, and very rudimentary sacrum, which is much narrowed, being scarcely wider above than at its apex, on account of the narrowness of its lateral masses; and the malformation of the ossa innominata, which are similar to that already described when speaking of the condition of that bone on the contracted side of Naegele's pelvis (*q. v.*, p. 481).

The result is that while both oblique diameters are contracted at the inlet, the transverse is particularly diminished, and this diminution increases progressively from above downward until the space between the ischial tuberosities at the outlet measures less than two inches. The vertical measurements of the pelvis are greater than usual, and

the ischial spines are nearer together. So great is the deformity that of seven well-authenticated cases, the Cæsarean section was required in six, according to Schroeder.

2. *Masculine or Funnel-shaped Pelvis.* — The peculiarities of this pelvis, which is rare, are that it approaches more nearly to the male than to the female type, and that it is somewhat like a funnel, being narrowed progressively from above downwards—hence the names applied to it are descriptive.

FIG. 166.



FUNNEL-SHAPED PELVIS.

The bones are usually larger and heavier than normal, the ridges which mark the muscular attachments are unusually developed, and the vertical measurements are greater than in the feminine type of pelvis. As regards the diameters of the inlet, the conjugata vera may be normal or diminished, but is usually increased slightly, and is greater than the transverse which may be lessened or normal. The lateral walls approach each other in the cavity, causing the transverse diameter to decrease more and more markedly, the pubic arch to be narrow and deep, and the tuberosities and spines of the ischia to be closely approximated. The sacrum also is poorly developed, as it is straighter, longer, and somewhat narrower than normal. The false pelvis shares in the deformity, as the iliac fossæ are narrow, the ilia more vertical, and the crests neither curved nor flared out as much as in the feminine type of pelvis. The cause of this anomaly is not well understood, but has been variously attributed to excessive muscular action producing "an advanced condition of ossification in a pelvis which would otherwise have been *infantile*;" to arrest of development; and to alteration of pressure due to a changed direction of the transmission of the body-weight.

3. *Certain affections of the spinal column* may produce a decrease in the transverse diameters of the pelvis; thus, *Kyphosis* (κύφωσις from κύφόω (κύπτω—root ΚΥΦ–) "to bend forward—to have a humped back), occurring in the lower lumbar region causes a retrogression of the sacro-vertebral angle, thus increasing the conjugata vera, while by

narrowing the sacrum and increasing its longitudinal curve, it allows the posterior superior spines of the ilium to be forced into closer proximity, and thus the transverse diameters are diminished while the oblique are slightly increased. The sacrum sometimes presents a convexity forward in its upper part; the ilio-pectineal line is almost straight, and the symphysis pubis projects. While the posterior superior iliac spines are closer together, the crests are less curved, and the anterior superior spines are further apart. The pubic arch is narrowed, and the distance between the spines of the ischia, as well as that between their tuberosities, is decreased. Thus the transverse diameters are gradually diminished from the inlet to the outlet until a condition somewhat resembling that of the funnel-shaped pelvis is attained below. The whole pelvis is tilted upwards anteriorly, and thus its obliquity is materially lessened.

The cause of kyphosis is usually to be found in caries of the vertebræ, and the deformities it produces in the pelvis must be ascribed to alteration in the direction of transmission of the body-weight due to the change in the normal curves of the spinal column, occurring in a region too low down for compensatory lordosis to take place.

4. *Double congenital dislocation of the hip-joint* also causes narrowing of the transverse diameter of the inlet, but contrary to what has been seen in the other varieties of transverse contraction, the ischial tuberosities are widely separated, whereby the breadth of the outlet is increased. Conversely, the antero-posterior diameter is greater at the inlet but narrowed at the outlet. The ilia are more nearly vertical, the distance between these crests much lessened, and the whole pelvis is tilted forward. The causes of the deformity are, the altered positions occupied by the heads of the femora, pressing the ilia inwards, and the alteration in the obliquity of the pelvis, causing a change in the direction through which the weight of the body is normally transmitted.

It is evident from the consideration of the anomalies which have been already briefly described, that not only will a contraction occurring at the inlet usually influence the shape and form of the outlet or cavity and *vice versâ*, but that contraction occurring in one diameter of a plane usually affects in some measure the others of the same plane; thus, in contraction of the conjugata vera, the antero-posterior diameter of the outlet is generally lengthened and the transverse diameter of the inlet also increased, etc.; but the anomaly next to be mentioned while often combined with increased curvature of the sacrum, superadded to some of the deformities enumerated above, still is frequently seen in pelves which are otherwise normal.

IV. *Anchylosis of the Sacro-Coccygeal Joint.*—This anomaly is frequently seen in old primiparæ, or in women who have not borne children for years and who are approaching the menopause, and deserves a passing notice, as it is frequently the cause of protracted labor in these classes of patients. It is especially apt to occur, if, in addition to the circumstances above narrated, the woman has been accustomed to lead a sedentary life. Normally there exists at the sacro-coccygeal joint an interarticular fibro-cartilage, which, it is said, *sometimes* contains a small synovial cavity; in other instances the first

piece of the coccyx becomes fused with the sacrum, and the joint exists between the first and second pieces of the coccyx. In either case, the space gained when the coccyx is pressed back during parturition by the presenting part, as it descends through the birth-canal, is considerable, augmenting the antero-posterior diameter of the outlet from half an inch to an inch and a half or even more. When this is prevented by anchylosis or fusing of these bones, the labor is generally delayed until a coccygeal fracture occurs, and, if the head is of normal size, instrumental interference often becomes necessary.

C. *Anomalies relating to the False Pelvis.*—These have been already alluded to in connection with the various anomalies of the true pelvis, and it will suffice to call attention here to some of the effects which they produce during pregnancy.

I. *Contraction of the False Pelvis.*—When the ilia are placed more or less vertically, and their crests approach each other more nearly than they should, the uterus as it rises out of the cavity of the true pelvis, not being supported by the iliac fossa, is, in the early part of the middle third of pregnancy, crowded down on the bladder and rectum causing great discomfort to the woman. This occurs also if the pelvis is tilted backwards, and increases proportionately as the plane of the inlet becomes more nearly horizontal. Again, if the false pelvis is contracted transversely, as the womb increases in size it may finally grow too large to be conveniently accommodated in it, and premature delivery may result, or, more frequently, the uterus may be forced to rise higher in the abdominal cavity, and, by pressure, interfere with respiration and with the functions of the abdominal viscera.

II. *Excessive amplitude of the false pelvis* occasions an increased liability to obliquities of the uterus and deviations from the normal presentation on the part of the fœtus (*v.* pelvis justo-major, p. 475).

FIG. 167.

BONY GROWTH FROM SACRUM OBSTRUCTING THE PELVIC CAVITY.

D. *Anomalies of the Pelvis due to Osseous Tumors, etc.*—Although the pregnant state predisposes to the development of exostoses, they are not commonly found of sufficient size in a position which would interfere with passage of the products of conception through the birth-canal, except in rickety or oblique ovate pelves. They are not infrequent, however, as small multiple outgrowths or bony spiculæ, and though not large enough to seriously delay birth they may, from their sharpness, injure the uterus or the child's head during parturition.

Various tumors may be found connected with the pelvic bones, but their occurrence is rare. Chief among these may be mentioned chondromata, osteo-fibromata, and osteo-sar-

comata, tumors which usually spring from the anterior and upper part of the sacrum, and which, by growing into the cavity of the pelvis, may more or less completely occlude it.

Vicious callus due to old fractures of the pelvic bones sometimes offers an impediment to delivery.

Causes.—After what has already been said on this subject when considering the different varieties of pelvic anomalies, it will only be necessary to allude briefly to the principal causes which produce them. They are: (1) arrest of growth and development; (2) a flexible condition of the bones; (3) the results of pressure; and (4) muscular contraction.

A. *Arrest of Growth and Development.*—In no part of the osseous system do such marked changes occur from childhood to full maturity as in the female pelvis. As these changes have been noticed at length in a former chapter it is only necessary to say that until the age of puberty the male and female pelves differ very little; but while the male only changes by growing larger and stronger, having more developed ridges and prominences which mark the attachments of muscles, and by the consolidation or fusing of the three segments which form the os innominatum, the female pelvis begins to develop until at the age of twenty years it has assumed the perfect feminine type. If this process of development is arrested, as sometimes occurs from disorders of nutrition, the deformity produced will depend upon the stage of development attained by the pelvis before the cessation of this process; and as this is usually accompanied by a checking or stoppage of the growth of the part, the pelvis will not only deviate from that of the normal female type in general configuration but also in size. This, probably, is a powerful factor in the production of the justo-minor pelvis occurring in dwarfs, and also in the masculine pelvis. But the growth may be checked while the process of development continues, and thus is produced the ordinary form of justo-minor pelvis.

It has been said that in Naegele's pelvis the deformity was due to an early anchylosis of the sacro-iliac joint which prevented the lateral development; that lack of development of one lateral mass of the sacrum exists cannot be gainsaid, but that this results or is dependent on anchylosis, seems exceedingly doubtful.

B. *A pliable condition of the bones*, allowing them to yield under pressure or from muscular contraction, is a fruitful source of anomalies of form. Two principal diseases induce this condition: (1) rickets, and (2) osteo-malacia; the one a disease of childhood quite commonly met with among the lower classes in the country, more particularly among children of the colored race, while the other is an affection occurring during adult life, and is so rare in this country that Dr. R. P. Harris, in collating data for his statistics regarding Cæsarean section, was unable to find a single instance where that operation had been performed in America on account of osteo-malacic pelvis.

I. *Rachitis or rickets*[1] is a disease of universal prevalence. It affects

[1] For a description of this disease the reader is referred to the standard works on Surgery and the various Systems and Cyclopædias of Medicine; also to articles in American Journal of Medical Sciences, April, 1872, by Dr. Parry, and Medical Times and Gazette, London, May 12, 1860, by Sir W. Jenner.

children, especially during the period of the first dentition, but rarely develops after the age of five years. It is a constitutional disease, characterized by an unhealthy state of the system at large, malnutrition and a softened condition of the bones, which permits of their bending in various directions, followed by increasing depositions of the earthy salts and a permanence of the distortion which has previously occurred. The changes which occur in the bones are essentially an increased proliferation of the cellular elements and a decrease in the deposit of earthy materials, particularly of calcium phosphate and carbonate. The temporary cartilage which is afterwards converted into bone is, in the early weeks of intra-uterine life, sufficiently stiff and firm to resist any influences which would tend to destroy its shape or impair its usefulness in after-life. As the muscles of the fœtus develop the matrix becomes calcified, and finally ossific matter is deposited in the bones which gradually begin to lose their cartilaginous character and to become firmer and more resisting, so that at birth the cartilaginous matrix of most of the bones has been rendered stronger by a process of calcification, and this in turn is being replaced by true bony tissue, which, however, as yet is not as strong and resisting as it will hereafter become.

Thus nature supplies our needs as they arise, and in early life increased firmness and solidity of the osseous framework proceeds hand in hand with increased power of the muscles and greater danger of injury to the bones from development of the power of locomotion. But should this balance be interfered with by disease—should the deposition of earthy salts be arrested in the growing bone from malnutrition, improper food, bad hygienic conditions, or any other cause, then any force, such as pressure, exerted upon the softened bone continuously, as by the weight of the body, or even muscular contraction, although the muscles participate in the disease and lose much of their power, will be sufficient to lead to distortion, which becomes permanent when the earthy salts are deposited in the bones as the diseased process abates. It will be noticed that in this affection the bones do not really *become* softened to any extent, but that as the earthy salts are not deposited in accordance to the requirements of the bones, they are wanting in firmness in proportion to increasing functions due to the development of the body and its rapid gain in weight.

The anomalies of pelvis form caused by this disease have already been described. They are, (1) the rachitic pelvis; (2) the pseudo-osteomalacic pelvis; and (3) the justo-minor pelvis; for, as has been previously stated, this disease may cause an arrest of bone-growth even should it not lead to alterations of shape.[1]

The degree of deformity will not only depend upon the direction in which its component bones are compressed by the spine and superincumbent parts on the one hand and the pressure exerted by the femoral heads on the other, which will vary with the habitual position of the child, but will also depend upon the degree of ossification in the separate bones when the compressing forces are brought to bear upon

[1] Holmes, op. cit., vol. iii. pp. 879 *et seq.*, and 895.

them; the cartilages being less yielding than the bones,[1] while the calcified matrix probably yields more readily than either.

II. *Osteo-malacia*[2] is, on the contrary, a disease of adults which causes a gradual withdrawal of the earthy salts from all parts of the skeleton, thus producing a softened condition of the bones, and leads to deformities on account of their abnormal pliancy. It is a rare disease, especially in America, where it is almost unknown. It occurs more frequently in women than in men, and pregnancy appears to act as a predisposing cause. It appears sometimes to be hereditary (Ekmann). Unfavorable hygienic surroundings, such as damp dwellings, and food which is insufficient in amount or deficient in lime salts, act also as factors in the production of this disease.

It is an exceedingly chronic disease and rarely terminates in recovery. Senator[3] says: "There are barely five instances of true recovery among about one hundred and fifty cases that have hitherto been reported." The extreme degree of deformity produced by this disease as it progresses has been already described. The deformity usually grows gradually worse with each succeeding pregnancy, and the labors are each more severe and protracted than their predecessors. As the distorted pelvis remains usually in its pliable condition it sometimes yields to the pressure of the presenting part, and after severe suffering on the part of the mother, a fœtus will occasionally be born through one of these pelves so deformed that delivery, *per vias naturales*, seemed impossible.

C. *Pressure.*—The subject of pressure, as a cause in the production of variations in the configuration of the pelvis, is so vast, that space will only permit of a very brief allusion to some of the more important considerations connected with it. A knowledge of mechanics is indispensable to the study of the effects produced by pressure in pelvic deformities, for it is only by the application of this science to the pelvis, that the forces producing such pressure can be decomposed and the resulting deformity accurately determined. This is the key-note to the various anomalies of form which have already been described.

Nature has formed the pelvis in the best possible manner for the transmission of the body-weight to the thighs under normal conditions; but should the centre of gravity of the body be altered by disease, a congenital dislocation of a thigh or anchylosis from hip-joint disease be present, the altered relation between the downward pressure from the weight of the trunk, and the counter-pressure from the head of the femora as well as the resistance offered by the articulation of the pubic bones—the one with the other, at the symphysis, interferes with the intention of nature—the normal pelvis is no longer the best adapted for transmission of the body-weight, and as a result nature sets about to remedy the evil as best she can, and produces a deformity,

[1] Sir W. Jenner, op. cit.

[2] For a full description of this disease the reader is referred to the larger works on surgery and general medicine.

[3] Ziemssen's Cyclopædia of the Practice of Medicine, Am. ed., vol. xvi. p. 226.

symmetrical or asymmetrical, as will best fulfil the object in view. All these changes are governed by the laws of mechanics.

Where there is increased pliability of the bones, the result is still under the guidance of the same laws, as a little study will show, governed also by the point of greatest weakness of the pelvis. Thus if the whole pelvis is equally softened by osteo-malacia the antero-lateral walls being the weakest would yield in the vicinity of the ischio-pubic foramina, or if the bones remain soft and flexible when they should become hard and resisting, as in rickets, the yielding would most readily occur at the point of greatest pressure, viz., the sacro-vertebral angle.

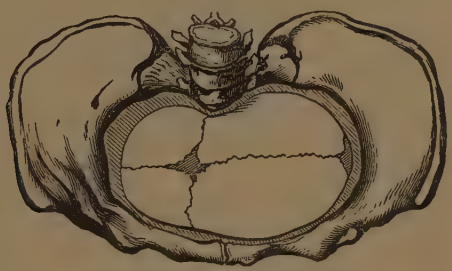
D. *Muscular Contraction.*—This is quite an important element in the several varieties of deformity, notably in the rachitic pelvis. Thus, for example, the psoas magnus, iliacus, erector spinæ, and pyriformis acting in pairs, would tend to depress the sacro-vertebral angle, and draw it forward; the glutei and the tensores vaginæ femoris to widen the iliac crests and increase the distance between the anterior superior iliac spines, while the recti femoris and the pectinei might, perhaps, aid in increasing the transverse measurement of the inlet. As the subject is not difficult, these illustrations will probably suffice.

Effects of Pelvic Anomalies on Labor.—It is obvious, that the effect of these anomalies on labor will depend upon the amount and variety of the deformity. Protracted labors, malpresentations, and prolapse of the cord, are among the more common consequences in such deformities, while from the increased force of the uterine contractions and the greater resistance to be overcome, rupture of the uterus may result. The dangers both to the mother and the child are augmented, and it is needless to say that these will depend upon the length of the labor, the possibility of overcoming the resistance, and the degree of operative interference necessary to complete the delivery.

If the deformity is not so great that an insurmountable obstacle is presented to the passage of the fœtus, nature so modifies the mechanism that, governed by Pajot's law, the smallest diameters of the head are brought into relation with the largest diameters of the pelvis. Thus it is found that when labor occurs in a woman with a "*rickety pelvis*," the head is not completely flexed, and the occipito-frontal diameter presents in relation with the transverse diameter of the inlet, which it will be recollected is usually increased in this form of pelvic anomaly. The head is inclined to the side in such a manner that the parietal bone which is toward the sacrum, is not as low down as that which is turned toward the pubis, or, in other words, lateral flexion of the head occurs ,the sacral or posterior parietal bone being nearer the shoulder of the fœtus than is its fellow. This is known as "Naegele's obliquity of the head." The bitemporal diameter corresponds to the antero-posterior diameter of the inlet, and as this is the smallest diameter of the fœtal head, it can usually be squeezed past the sacro-vertebral angle, though sometimes only after much overlapping of the bones, and it may be, deep indentation of one of the parietal bones. After this point is once passed, the obliquity rights itself, more thorough

flexion occurs, and as the pelvic cavity and outlet are usually normal or somewhat enlarged, the labor proceeds as in normal cases.

FIG. 168.



THE GREATER SPACE FOR THE BI-PARIETAL DIAMETER AT THE SIDE OF THE PELVIS IN CERTAIN CASES OF DEFORMITY.

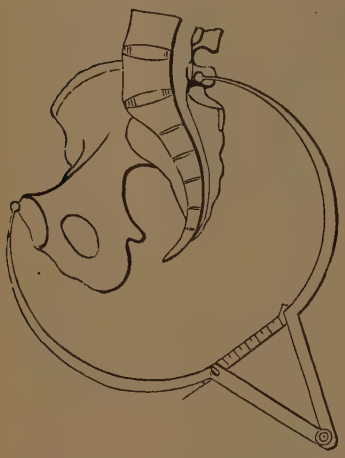
In *justo-minor pelves*, or in *pelvis contracted transversely*, the occiput enters usually as in normal labor, except that flexion is extreme. Should the pelvis be larger in the cavity or outlet, the flexion will diminish somewhat after the inlet is passed, and the head will be born by extension in the usual manner; but should the pelvis be much contracted throughout, there may not be room for this movement, nor even for the head in its flexed condition, and the latter becoming "jammed" in the pelvis will usually require perforation and lessening before it can be extracted.

Diagnosis.—It is not necessary, even were it possible, to subject every pregnant woman to the annoyance of measuring her pelvis. Should, however, anything lead the obstetrician to suspect the existence of an anomaly of size or shape, in any particular case, he would be exceedingly neglectful of his duty did he not use every possible means at his disposal to learn all he could in regard to these points of the pelvis in question, as his scientific treatment will in large measure depend upon this knowledge. If then he finds anything in the stature, carriage, or gait of his patient, or in her previous history, either as a child or as a parturient woman, which would indicate any of the deformities or causes of deformities which have been previously described in this chapter, he would do well to investigate what effect they have had upon the pelvic conformation and diameters. If the woman is of small stature, especially if this is due to rickets or to curvatures of the spine; if she gives a history of increasing difficulty with each parturition and gradually decreasing stature, as occurs in osteo-malacia; if she habitually carries her body bent in such a manner that the normal centre of gravity is necessarily altered; if she limps in her gait from some long-standing luxation of the hip-joint, which has not been reduced, or from anchylosis of this joint or disparity in the length of the limbs; if she gives a history of labors protracted in the second stage and perhaps terminated habitually by instrumental interference, or if she has had a series of malpresentations in her former confinements, it is best to take

certain measurements of the pelvis, which at least give an idea of the nature of the deformity when present.

External Pelvimetry.—To measure the pelvis the patient should be placed in the dorsal recumbent position on a hard level surface, having her head and shoulders slightly elevated by a pillow, her thighs flexed on the abdomen, and her knees on her thighs. Her pelvis should be as near the edge of the table as possible. The pelvimeter of Schultze and that of Baudelocque are perhaps the most convenient instruments (Fig. 169). To measure the *external conjugate* or *diameter of Baudelocque* the patient turns on her side and one extremity of the pelvimeter is placed in the hollow usually found below the last lumbar spine, or in other words over the spinous process of the upper segment of the sacrum, while the other rests upon the middle of the upper border of the pubic symphysis. The external conjugate usually measures in a normal pelvis from seven and a half to eight inches. From this subtract two inches and a half for the thickness of the sacrum, and one inch for the thickness of the pubis and soft parts, and the remainder *approximates* the measurement of the conjugata vera. This approximate measurement however is fallacious, but if the external conjugate measures above seven and a half inches, a contracted conjugata vera is rarely met with, while if this measurement is much less than that given above, deformity nearly always exists.

Fig. 169.



Buadelocque's Pelvimeter Measuring the External Conjugate.

To measure the *distance between the anterior superior iliac spines*, the patient turns on her back and the extremities of the instrument are directly applied to these points. This measurement varies greatly, but may be said to average from nine and a half to ten inches.

To measure the *greatest distance between the iliac crests*, the points of the instrument are moved backward and forward along the crests until the greatest distance is obtained. This usually measures from eleven to eleven and a half inches.

From these last two measurements very important facts can be deduced according to Spiegelberg. 1. If these measurements are less than they ought to be, but maintain their normal relation to each other, it denotes a unformly contracted pelvis. 2. If that between the iliac crests is normal or but slightly diminished, while that between the spines is increased, the conjugata vera is contracted, but the pelvis is not otherwise deformed. 3. If both are diminished and their mutual relations changed so that the distance between the spines equals or exceeds the distance between the crests, the conjugata vera is not alone deformed, but the pelvis is generally contracted as in the pseudo-

osteomalacic variety. A glance at the description of the deformities of the crests and spines spoken of when describing rachitic pelves will show the justice of these deductions. In order to complete the subject of external pelvimetry it is advisable to pass by for the present the verifications of these deductions by internal measurements, and proceed with the external measurements resorted to, in order to diagnose *asymmetry or oblique deformities of the pelvis.* 1. Compare the distance from the tuberosities of either ischia to the opposite posterior superior iliac spines; 2. From the anterior superior to the opposite posterior superior iliac spines; 3. From the trochanteres majores to the opposite posterior superior iliac spines; 4. From the under surface of the anterior margin of the symphysis pubis to the posterior superior iliac spines; 5. From the spinous process of the last lumbar vertebra to the anterior superior iliac spines of either side.[1] According to Naegele the distance is shorter on the contracted side in all of these comparisons except the fourth, in which it is increased. Perhaps it is safest to say with Playfair that should these measurements vary on the two sides by half an inch to an inch, obliquity of the pelvis is almost invariably present. To confirm the diagnosis let the patient stand erect and let fall two plumb lines, one from the spine of the sacrum, the other from the symphysis pubis. "In a normal pelvis these will fall in the same plane, but in an oblique pelvis the anterior line will deviate considerably toward the unaffected side." The transverse diameters of the inlet and cavity cannot be measured with any degree of certainty; but that of the outlet can be readily measured between the ischial tuberosities.

Internal Pelvimetry.—The hand is the best pelvimeter for taking the internal measurements. To arrive at the measurement of the *conjugata vera* it is first necessary to get the *conjugata diagonalis*, *i. e.*, the diameter measured from the sacro-vertebral angle to the under surface of the subpubic ligament. This measurement is best obtained as follows; the index and middle fingers of one hand are introduced into the vagina, and depressing the perineum while the patient assumes more of the gluteo-dorsal than the dorsal recumbent position, are carried backward to the concavity of the sacrum, and then upward along its curve in an endeavor to reach the sacro-vertebral angle. In a normal pelvis this cannot be touched, because the distance from the subpubic ligament to the sacro-vertebral angle, and the distance from the latter point to the apex of the sacrum or to any point on a straight or convex plane extending between the subpubic ligament and the sacral apex, is further than can be reached by the longest fingers; but should deformity be present the case is different, as the sacrum in contracted pelves is nearer the symphysis pubis. When the fingers in the vagina touch the sacro-vertebral angle, the point of contact between the hand to which they belong and the subpubic ligament is carefully marked, and the fingers being withdrawn, the length of the conjugata diagonalis can be readily measured from the mark made on the hand

[1] For the *rationale* of these measurements the reader is referred to the description of the oblique ovate pelvis.

to the finger-tips. The triangle formed by the sacro-suprapubic and the sacro-subpubic diameters joined by a line corresponding to the posterior surface of the pubis, is in the normal pelvis a scalene triangle, the longest side of which corresponds to the sacro-subpubic diameter. In order to obtain the useful or minimum conjugate diameter from the diagonal conjugate, the height of the pubic symphysis must be determined, and if it is not more than one and a half inches, the subtraction of two-thirds of an inch from the diagonal conjugate will give the measurement of the minimum conjugate with sufficient accuracy; should the height of the pubic symphysis exceed this measurement, however, three-quarters of an inch must be deducted from the length of the conjugata diagonalis. As the triangle above referred to may be altered to an isosceles triangle on the one hand or an obtuse angled triangle on the other, by the symphysis approaching more to a horizontal or vertical position, or by the depression or elevation of the sacro-vertebral angle, the above formula of Speigelberg is not absolutely accurate without the factors just alluded to are also considered.

To obtain the measurement of the obstetric *antero-posterior diameter of the outlet*, the patient is placed on her side and the sacro-coccygeal joint is found from the outside. While the index finger of one hand marks its situation, the index finger of the other is passed into the vagina and this point is touched from the inside, so that the soft parts and the joint only intervene between the fingers. The external hand is now removed and a mark is made on the other hand where it comes in contact with the subpubic ligament, and when the finger is withdrawn the measurement from its tip to the mark on the hand gives the antero-posterior diameter.

Treatment.—The management of labor occurring in a woman who has an anomaly of the pelvis requires the careful consideration of several points. I. It is necessary to take into consideration the *probable size of the child.* Some idea of this may be gathered from knowledge of (*a*) *the size of the father*, for, as a rule, the larger the father, the larger will be the size of the offspring; (*b*) whether the woman is a *primipara* or a *multipara*, for statistics show that the first is apt to be smaller than the succeeding four or five children; (*c*) *the age of the mother*, for the last child born prior to the menopause is apt to be small; (*d*) the *history of former confinements*, and finally (*e*) from *abdominal palpation.*

II. The next thing to consider is *whether the bones of the head will yield readily to pressure*, thus enabling it to be moulded to fit the distorted planes, through which it has to pass. In determining this point, the most important element on which to base a calculation is the *age of the fœtus*, for if it is premature, ossification has not advanced as yet to a sufficient degree to present a serious obstacle to moulding, while if at full term, or if the pregnancy has been prolonged beyond the usual duration, the firmness of the bones renders the prognosis grave for the child and delivery more difficult for the mother or for the obstetrician should he attempt version or apply the forceps.

III. The most important consideration, however, is the *size of various diameters of the pelvis.* It may be laid down as a rule, that *if the con-*

jugate diameter is less than three inches, and the transverse less than four inches, a living child of normal size cannot pass through the pelvis. If the diameters are greater than this, it is possible for the child to be born alive, although if the conjugate measures only three and a quarter inches it is exceedingly improbable, without the transverse diameter is enlarged in a compensatory degree. It may also be said that *if the sacro-pubic diameter is less than two inches, a full term fœtus cannot be delivered through it, whether it be living or dead;* indeed, if the conjugate should even be half an inch larger than that, the risk to the mother from craniotomy is very great.

Supposing that the *diameters are sufficiently great* to allow of the birth of a living child, what is the duty of the obstetrician? Here, at once, arises a disputed question. Some physicians believing in the forceps as especially of use in these cases, others preferring to perform podalic version, while others pin their faith on the induction of premature labor. The truth, as usual in such cases, probably is, that in selecting the cases to which either method of treatment is best adapted, and not treating all cases alike as a routine, the greatest success will be found. At first thought the *forceps* would seem to be the best means to overcome the obstruction, and so it is, to a certain extent. It is, however, much more difficult to apply than in an ordinary case of delay in the second stage from uterine inertia, for the head is high up, and in many cases has not entered the pelvis. The difficulty of delivery and the amount of traction necessary to effect it are often very great, although Tarnier has reduced this to a minimum by the invention of the axis-traction forceps. The character of the case must also be considered, for if the head is presenting in the contracted diameter of an oblique pelvis, and is not fixed, it would be bad practice to apply the forceps and endeavor to extract through such a diameter, while the opposite oblique was roomy enough to allow the easy passage of the head. But if the head has entered the pelvis and is fixed and stationary, the axis-traction forceps should be applied, and an attempt made to deliver.

In regard to *version*, this manipulation can neither be performed in every case, as where the head has entered the inlet and is fixed, nor is it advisable always to attempt it. If the head should be large and well ossified, nothing would be gained ordinarily by version, because when the child is once turned it is advisable to deliver rapidly, if its life is to be saved, but as the body does not dilate the canal very thoroughly, and as the head does not easily become moulded in such a fœtus as that just described, the labor could not be hastened sufficiently to save the life of the child. Again, suppose podalic version was performed, and that, owing to the size of the child, delivery was impossible, the difficulties in the way of craniotomy would be much increased. If, however, the fœtus is small or premature; if the head is not too firmly ossified to admit of being easily and rapidly moulded; if it occupies a contracted oblique diameter when, by version, it may be made to occupy the other, which is sufficiently large to allow it to pass, or if the antero-posterior diameter is not too small to allow the passage of the bi-temporal diameter, while the

transverse is enlarged sufficiently to admit the occiput at one side (*vide* Fig. 168, p. 491), this manipulation may often be resorted to with the happiest effect.

If the abnormality of the pelvis is recognized in time, the advisability of *inducing premature labor* will be thought of. This undoubtedly offers the best chance, both for the mother and the child. If the child can be delivered at seven and a half or eight months, it will be sufficiently small, and its head is so readily mouldable that it can be delivered usually by podalic version with great facility. To sum up, then, the treatment of cases of this class:—

1. If the deformity is recognized in time, induce premature labor at seven and a half or eight months, perform podalic version and deliver.

2. If not seen until too late for premature labor, do not be in too great a hurry; allow nature to mould the head; then apply the forceps and deliver, or perform podalic version, according to the indications present in the case.

If the pelvis is *too small to allow the passage of a living child*, and this condition is known early in pregnancy, it may be best to induce abortion, as this exposes the mother to the least risk. If this is determined on, it had better be done at as early a date as possible, in accordance with the rules laid down in the chapter on that subject. If, however, the pregnancy has reached its end and labor has begun, the treatment is narrowed to a choice between craniotomy or Cæsarean section, or some of its substitutes. The former is generally preferred, because less dangerous to the mother; but there are some who think and teach that after craniotomy has once been performed in such a case, and the woman has been made to understand her condition, she should, if again pregnant, suffer the risks of an abdominal section, and give the child a chance for its life. As the physician's first duty is to the mother this rule is not likely to meet general acceptance, or be widely put in practice, until the mortality of the Cæsarean operation is materially lessened. The results recently obtained appear to justify a hope that, at some future time, it or some other method may be found as a substitute for craniotomy, which will give an equal chance to both the mother and the child. *If the pelvis is too small for the passage of a child, living or dead*, Cæsarean section, or one of its substitutes, must be performed.

CHAPTER VIII.

PATHOLOGY OF LABOR (*Continued*)—INJURIES OF THE VULVO-VAGINAL CANAL—TEARS AND RUPTURES OF THE UTERUS—RETENTION OF PLACENTA—POST-PARTUM HEMORRHAGE.

Injuries of the Vulvo-vaginal Canal.—Various injuries, such as contusions, tears, and ruptures of the vulvo-vaginal canal, may be received in childbirth; most of them are spontaneous, but some may be caused by the hand or by instruments. The most frequent of those requiring professional treatment are ruptures of the perineum. The causes of this accident and the means of preventing it have been presented, and we are now concerned only with its treatment.

The majority of obstetric authorities hold that, as a rule, a torn perineum should be stitched as soon as practicable after the injury, or at least that the operation be not delayed longer than sixteen hours. When performed immediately it arrests hemorrhage which, in some cases, is considerable, but in all cases an early operation lessens the danger of septic infection taking place through the raw surfaces; and though a rent that seems great at first becomes comparatively small in the course of three days, yet spontaneous restoration is not the rule, while restoration is, after perineorraphy, and, therefore, this ought to be done unless there are some strong contra-indications.

The practitioner will need a disinfectant solution, as of carbolic acid, or of corrosive sublimate, sponges, a pair of scissors for trimming any ragged projections from the wounded surface, needles, needle-forceps, material for sutures, and perforated shot with a shot compressor, if this mode is chosen for fastening the stitches. Horsehair, silk-thread, silkworm-gut, catgut, and silver and iron wire have been successfully used as sutures; if a selection can be made it will probably be best for the operator to use silkworm-gut, or properly prepared catgut, applying the latter in the form of the continuous suture. When the rent does not require either rectal or vaginal sutures, an ordinary large, straight sewing needle, about an inch and a half in length and properly annealed, answers well for the external sutures; if internal stitches are used, a shorter needle curved near its point will be needed. The needle may be directly threaded with the material for sutures; if wire be used many prefer to first thread the needle with silk, and then the former is carried through by the silk.

The patient lies upon her back with her hips near the edge of the bed, her body being transverse; the vagina is washed out with an antiseptic solution, and the wounded surfaces well cleansed; a clean sponge that has been thoroughly disinfected is placed in the vagina above the rent for the purpose of absorbing the discharge from the uterus,

and thus prevent it from hiding or obscuring the field of operation; if the rent involves the recto-vaginal wall the rectum must be washed out, and a tampon of salicylated cotton, to which a string is attached, passed above the rent, to prevent any fecal particles coming in contact with the surfaces of the wound. The use of an anæsthetic will be decided by the condition of the patient, her sensibility, and the length of the operation; if only one or two stitches are to be introduced, it is quite possible that the sensation in the parts may have been so obtunded by severe pressure that the introduction will cause very little suffering; should anæsthesia be necessary it must not be complete lest consequent uterine relaxation permit dangerous hemorrhage.

Loose shreds of tissue if present should be cut off, and then in case the tear does not extend into the rectum, the index finger of the left hand is introduced into the latter and the needle, armed immediately or mediately with the suture, is made to penetrate the skin near the angle of the wound half an inch from its margin, and guided in part by the finger in the rectum is carried to the other side, being completely hidden in its course beneath the tissues, and emerges from the skin at a point corresponding with that at which it entered; if difficult or impossible to pass the entire distance with the needle at once, it may be drawn out in the middle of the furrow and reintroduced. The first suture having been placed in position, a second is similarly introduced, and then if necessary a third. If the sutures are of wire they can be secured by twisting or by perforated shot; silkworm-gut, horsehair, or silk thread may be tied, or compressed shot used for the first. The surfaces must be brought in close and accurate contact, no clots of blood intervening, and care must be taken that either inversion or eversion of any portion of the margins does not occur; the sutures should not be drawn so tightly that there is any danger of their cutting out. If vaginal sutures are used they should be introduced first; if the laceration is complete, and only external sutures are employed, the first and second at least will when introduced appear in the deepest part of the rent, crossing near the rectal surface. After the operation is completed the vaginal sponge is removed, and also the rectal tampon, if the latter has been employed.

Alloway[1] advises using only one suture in incomplete rupture. He employs Emmet's straight perineum needle and a silk suture; the needle is entered at the left side of the tear half an inch from its margin and near the upper part of the rent, or that which was first torn: "Two fingers in the rectum press up the rectal wall and recto-vaginal cellular tissue, so that the needle can be rapidly, though steadily, made to glide beneath the tissue and over the rectum, hugging the latter as closely as possible; the needle passes out at a point on the opposite or right side, corresponding with that upon the left side at which it entered."

Koeberlé freely divides the anus posteriorly, the incision extending beyond the circular fibres and involving the connective tissue behind the rectum. Schroeder advises posterior subcutaneous section of the sphincter. Excellent results may be had from the continuous catgut suture in the treatment of these lesions. The needle threaded with catgut is introduced at the

[1] American Journal of Obstetrics, January, 1884.

side of the apex of the wound in the vagina, and the end of the catgut tied, then the two sides are stitched together with alternate deep and superficial sutures, until the vulvar orifice is reached, when another needle similarly armed is introduced in the skin at the side of the wound posteriorly, the catgut fastened, and a continuous suture is made to the anterior margin of the rent, after which the two ends of the sutures are tied together. To prevent injurious consequences from any of the stitches giving way, occasional knots may be tied as the sutures are introduced. For the success of this method the catgut must be aseptic, sufficiently strong, and so prepared that it will certainly be absorbed in eight or ten days.

After-treatment.—By some it is held important to tie the knees together, to use the catheter at regular intervals, and to keep the bowels confined for a week or more. By no probable movement of the limbs can there be any strain upon the perineal tissues now sewed together —tissues that have undergone the very great stretching in labor—and therefore the bandaging of the knees is unnecessary; moreover the bandage increases the discomfort of the patient, helps to imprison the lochial discharge in the vagina, and is thus an injury. Hildebrandt objects to the use of the catheter because vesical catarrh is very liable to result, and thinks it better for the urine to be discharged spontaneously if possible. Once in twenty-four hours the vagina should be carefully washed out with a warm antiseptic injection. On the third day the bowels may be moved by castor oil or by compound licorice powder, assisted by an enema of warm water or an infusion of flaxseed; subsequently evacuation should be had at least once in forty-eight hours. The diet need not vary from that usually given after labor. The common practice is to remove the sutures in from eight to ten days Schatz,[1] however, advises leaving them for two weeks, and this is probably the better plan; of course the sutures if of catgut require no subsequent attention after their introduction, except, should any of them give way too soon, it will be better to introduce new ones. The patient must not sit up before the expiration of two or even of three weeks.

Central rupture of the perineum has occasionally occurred, and the head and then the body of the child has passed through this opening, the anterior and posterior portion of the perineum being uninjured; in other instances the rent has been caused by the foot or elbow of the child.

Duncan[1] asserts that the passage of the child through such a rent rarely happens, that this is probably sometimes believed in after the event, but is not carefully observed during the process. Reeve[3] has reported a case of central rupture of the perineum without implication of the vulva occurring in a multipara. "The rent began on the right side, near the junction of the upper fourth with the lower three-fourths of the labium, followed the outer boundary of the labium downwards, and crossed the perineum to the rectum; both the anal sphincters were divided, the laceration extending upwards quite an inch and a half. The part of the perineum remaining intact at the posterior commissure, and along the lower part of the right labium was about the thickness of a man's thumb."

[1] Archiv für Gynäkol., 1884.
[2] Transactions of the American Gynecological Society, vol. i. [3] Ibid., vol. iii.

Duncan[1] has called attention to the fact that central perineal rupture may involve only the skin, or the mucous membrane of the vagina, or both of these with their subjacent tissues while there remains entire some tissue intervening between the skin and the vagina.

Charpentier[2] advises if the rent takes place when the obstetrician is present, to immediately divide the anterior bridge, thus protecting the anus from injury; but if not seeing it until the labor is over, the bridge is to be left; in either case the torn surfaces are to be united by the continuous catgut suture. Tears may occur in the anterior or lateral portions of the vulva, giving rise to more or less serious hemorrhage; the bleeding can generally be arrested by sutures used to unite the torn surfaces, but it may be necessary to apply a compress that has been dipped in an astringent solution.

The vagina may be injured by the forceps. Occasionally the point of one of the blades has penetrated Douglas's cul-de-sac, and again the wound has been inflicted by an effort to rotate the head anteriorly, or, though less frequently, in traction. Tears in the vagina are peculiarly liable to occur, according to Winckel,[3] in old primiparæ and in those who have suffered for a long time from severe inflammatory catarrh of the vagina, especially when the passage of the head is rapid. The vagina has been torn, too, by the careless extraction of fragments of bone or of the fœtal head, after craniotomy. Sometimes the head has been impacted, and the tissues so bruised that sloughing follows, which, if deep and on the anterior wall, may open into the bladder causing genito-urinary fistula, or if upon the posterior wall, into the rectum, and a recto-vaginal fistula is the consequence.

Spontaneous ruptures of the upper portion of the vagina are often associated with rupture of the uterus; generally they are transverse, and the vagina may be completely detached from the uterus, while, on the other hand, those tears that occur in the middle portion of the vagina are usually longitudinal. These tears have also been caused by the introduction of the hand to perform version in shoulder-presentation. Neoplasms of the vagina, carcinoma for example, predispose to its tearing. In rents of the vaginal vault the child may pass into the peritoneal cavity. The treatment of rents of the vagina, if discovered prior to the delivery of the child, and if considerable, consists first in artificial ending the labor. Hemorrhage may require sutures, injections of hot water, or direct pressure upon the bleeding part.

Thrombus or Hæmatoma of the Vulva or of the Vagina.—In addition to the injuries that have been mentioned, there may be tearing of the vessels of the connective tissue of the vulva or of the vagina without external opening, and the effused blood forms a mass known as labial, or vulvar, or vaginal thrombus or hæmatoma. This is not a frequent accident. Deneux,[4] in a practice of more than forty years, saw but three cases, and Dubois a like number in 14,000 deliveries. Winckel gives

[1] Op. cit. [2] Archives de Tocologie, 1885.
[3] See Treatise on Child-bed. Translated by Dr. Chadwick.
[4] Maladies Puerpérales, Hervieux.

the proportion as 1 in 1600. It is at least relatively more frequent in primiparæ than in multiparæ. Varicose veins are not a predisposing cause; Perrot's statistics, including forty-three cases, show that this condition was present in only two; Barker states that in a very large proportion no such condition preceded the thrombus.

Among the causes of hæmatoma mental emotion, violent vomiting, and coughing have been given. But laying aside this doubtful etiology, we may say with Hervieux that the determining cause of this affection in labor is the prolonged stay of the head in the pelvic cavity, the delay arising from narrow pelvis, from resistance of the perineum, from size of the fœtus, etc., and hence excessive efforts on the part of the patient to overcome the obstacle to delivery. Perrot has shown that there may be a gliding of the vaginal walls upon the peripheral tissues, so that a partial detachment occurs from tearing of portions of the connective tissue, and thus spaces are formed in which blood poured out by the ruptured vessels collects. Or it may be that the walls of vessels are thinned by the great pressure from the fœtus, and when that pressure ceases, a new wave of blood distending them, they give way. According to some authorities the vessels that rupture are venous, but Winckel says there is no question that the wound of an artery, as well as of a vein, may give rise to a hæmatoma, even though the effusion is most commonly of venous origin. In 35 out of 43 cases given by Perrot the hemorrhage did not occur until after labor. Dewees[1] has given an instance where the tumor formed ten minutes after the birth of the first of twins, and was ruptured by the descent of the second child, the patient recovering:—

Madame Sasanoff, in connection with a case under her care in the Maternity of Kolonna, St. Petersburg, has reported five others[2]—that of Dr. Dewees not being included—as the only ones she could find published where the hæmatoma formed in the interval between the birth of twins. Of these five, four were fatal. She believes the rule of practice ought to be that, when there exists the least appearance of the formation of a thrombus, the delivery should be hastened, and that in this point of view version and extraction of the second child should receive a large application, so much the more as the escape of the first child favorably affects the dilatation of the orifice, and facilitates the introduction of the forceps or the hand into the genital canal. If the delivery be delayed the hæmatoma rapidly increases in size, and rupture or incision may be necessary for the passage of the child, and such early rupture or incision makes the prognosis quite unfavorable.

The swelling it occasions usually is manifested a short time after labor, but its appearance may be delayed for several days. Schroeder refers to a case reported by Helfer, in which it was first seen on the twenty-first day, but in such instances the exciting cause was violent bodily exertion.

Hæmatoma of the vulva is more frequent than of the vagina. The labia majora are oftener affected than the labia minora. The effusion

1 Diseases of Females: Of Bloody infiltration in the Labia Pudendi.
2 Annales de Gynécologie, December, 1884.

may extend to the connective tissue, making a vulvo-perineal thrombus: "The blood is generally extravasated into the subcutaneous cellular tissue in the perineum between the superficial and median fascia, in the vagina into the submucous tissue, or into the cellular tissue encompassing the vagina; yet there are cases (Cazeaux and Hugenberger) in which it has extended along the vagina up to the peritoneum cellular tissue, and posterior to the peritoneum up to the kidneys, anteriorly in front of the peritoneum up to the navel, and on the sides as far as the sacrum."[1]

The tumor varies in size from that of a pigeon's egg to that of a child's head. It is in the majority of cases unilateral; and its formation is usually preceded by severe pain; the surface is smooth, discolored, livid or violet, and the tumor itself presents to the touch more or less elasticity with or without fluctuation. If the hemorrhage be great the symptoms of acute anæmia are present, but death does not follow unless the hæmatoma ruptures, and then it may be very rapid. Recovery generally takes place. Thus Winckel found only six that were fatal in fifty; Barker met with two deaths, both from puerperal fever, in thirteen hospital cases, while of nine in consultation and in private practice, all recovered. The prognosis will be governed by the size of the thrombus, and by whether it occurs before or after delivery; the larger the tumor, of course, the greater the danger, and so, too, the case is more favorable if the formation occurs after the labor than during it. The termination may be by resolution, and this may happen even if it be as large as the fist, by suppuration, by rupture, or by gangrene.

Treatment.—During the formation of a hæmatoma we should endeavor to lessen the effusion of blood by the application of an ice bag and by compression. If rupture occurs, an astringent tampon should be applied and pressure also used. If it form during labor, and presents an obstacle to the delivery of the child, even by forceps, though such condition is quite exceptional, "incise at once, remove all the clots that have formed, and then deliver by the forceps," and afterward compresses of cotton batting saturated with the solution of persulphate of iron are to be used, and pressure made, constitute the directions of Barker. After labor incision may be rendered necessary by threatened gangrene; but it is always better if this can be delayed for three or four days after the development of the hæmatoma, for, as observed by Schroeder, the longer we can wait the less danger from consecutive hemorrhage; nevertheless, Chaussier mentions a case in which the incision was not made for a week, yet hemorrhage occurred, and Baudelocque one where the opening was not made until three weeks after the tumor was formed, and the following hemorrhage was so great as to require the tampon.

Rupture and Tears of the Uterus.—It is very rare that rupture of the uterus takes place in pregnancy, yet a few cases are recorded even where the accident happened in the first half of pregnancy, some indeed as early as three months, and one at two. From the fourth month the uterus becomes more exposed to injury from external causes, as blows,

[1] Winckel, op. cit.

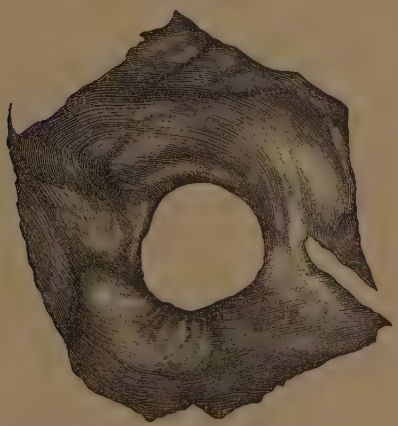
falls, and incised, contused, gunshot, or lacerated wounds, as from the horn of an animal. Spontaneous ruptures are still more rare than accidental. It may be admitted that in some cases of the accident there have been changes in the uterine wall by which its tissue is weakened at the part where the injury occurred, as after the Cæsarean operation, or from interstitial tumors; the rupture may then be determined by a comparatively slight cause, as vomiting, coughing, lifting a heavy weight, or dancing; it may even be produced without any recognized etiology. The seat of this spontaneous rupture is usually at the fundus or adjacent to it.

The symptoms of rupture of the uterus in pregnancy are similar to those observed in rupture of an extra-uterine gestation cyst, the dangers the same, and the treatment should be the same.

Trask, whose important study[1] of this subject is so well known, states, in referring to rupture in the early months of pregnancy, whenever symptoms of collapse have followed a severe mechanical injury, and are accompanied by pains more or less severe in the region of the uterus, especially if accompanied at once, or within a short time, by any degree of hemorrhage from the vagina, we have strong reasons for believing this accident has taken place. Again, in referring to the diagnosis of spontaneous rupture, he observes when symptoms of collapse follow a sudden exclamation on the part of the patient, that something has burst within her, and are accompanied by pains in the uterine region, and hemorrhage from the vagina, we may reasonably suppose that the uterus has ruptured, and we should act accordingly.

Some tearing of the vaginal portion of the cervix occurs in almost every labor, especially in the case of a primipara; it is a very rare ex-

FIG. 170.



ANNULAR SEPARATION OF THE CERVIX UTERI.

ception when the latter escapes such injury; there are physiological tears, they are generally longitudinal and lateral, the injury being

[1] American Journal of the Medical Sciences, 1848 and 1856.

usually more marked upon the left side, but in some instances the posterior lip is torn in the median line. Usually these tears heal during the puerperal state, and it is only exceptionally that ectropion of the lips with catarrh and disordered menstruation follows the injury. In some instances, however, the tear beginning at the os extends farther up the cervix, and even may involve the peritoneum. This accident may be spontaneous, or it may be caused by the use of the forceps before the os is dilated, or result from an incision made to overcome rigidity of the os. Still another variety of tear involving the neck is when this is so unyielding and the uterine force so great that a cervical ring is detached as shown in Fig. 170. This accident has, according to Kormann, been observed only twelve times.

Passing from these rarer or usually less important injuries of the uterus in childbirth, we come to consider ruptures of the uterus. The frequency of this accident is variously given by different authorities. Collins, 1 in 482 labors; McClintock, 1 in 737; Ramsbotham, 1 in 4429; Bandl, 1 in 1200; Jolly, 1 in 3403.

Causes—Multiparity.—Charpentier[1] explains the action of multiparity as producing thinness, transformations in the tissue of the uterus, among which is a fatty degeneration more or less advanced as a consequence of repeated pregnancies, an enfeebling of uterine power, and, according to Scanzoni, greater frequency of shoulder presentations. Some authorities, however, reject any degeneration of tissue as predisposing to rupture, Kleinwächter, for example, holding that the most frequent variety of rupture is that of healthy uteri, for they only contract powerfully. Certainly in many cases no degeneration in the uterine tissue has been found. The explanation of the greater frequency of it in multiparæ is in part that suggested by Scanzoni, and in part the greater size of the children. According to Bandl the accident is more frequent in the poor than in those who are in comfortable circumstances. Changes of the structure of the uterus originating in placental endometritis, caused by syphilis, are referred to by Kormann as leading to the accident. The sex of the child may be a factor in causing the injury. Thus of 67 children born, 48 were males, and only 19 females.

Disproportion between the fœtus and pelvis is a frequent cause. This want of proportion may be in consequence of narrowing of the pelvis, or either physiological or pathological increase in size of the fœtus. The greater frequency of the accident in case the child is hydrocephalic has been previously stated.

Radford's observation, confirmed by other observers, that rupture is more frequent when the pelvic narrowing is moderate than when it is great, is explained by Playfair as owing to the fact that great contrac-

[1] Playfair states, "Tyler Smith contended that ruptures are relatively as common in first as in subsequent pregnancies." Charpentier says, that all authors, except Tyler Smith, admit the influence of multiparity. How these statements can be reconciled with the following language, let others decide: "It is an interesting and remarkable fact that ruptures of the uterus seldom happen to primiparous women." (Lectures on Parturition and the Principles and Practice of Obstetrics. By W. Tyler Smith. Lancet, vol. ii. p. 495.)

tion of the pelvis is comparatively rare. But a more probable explanation is that in moderate contraction the presenting part with the cervix and lower portion of the body can descend into the pelvic inlet, and then the uterine tissues are compressed between the head of the child and the pelvic wall; but where the inlet is greatly narrowed such descent is impossible, and hence compression of tissues does not occur.

Cicatrices of the uterine wall from accidental wounds or from the Cæsarean operation have in some cases contributed to this accident. Presentation of the shoulder has been found in fourteen of eighty-four cases. The improper administration of ergot is responsible for many cases. The late Dr. Hodge stated that he never met with this injury, with perhaps one exception, where ergot had not been administered; Dr. Meigs has referred to three, and Dr. Bedford to four cases of rupture resulting from the use of ergot; instances too are given by Marrot,[1] and it would be easy to increase the list to large proportions of the injury thus caused, occurring especially in the practice of midwives.

Thinning of the uterine wall was stated by Trask to have been present in fourteen out of forty-nine; Barnes, too, admits it as a cause, but Jolly only exceptionally, and Bandl, as we shall see in studying the mechanism of the accident, makes thinning of the cervix an essential precedent of the rupture.

Among other causes that have been adduced are excessive resistance, either of the cervix from rigidity, obliteration of the os, cancerous degeneration, or from pelvic obstruction, such as tumors, or from vaginal stenosis. Traumatic ruptures have occurred especially in shoulder presentations during version; they have also been observed in application of the forceps or of the cephalotribe.

Position and Extent of the Injury.—The lesion may occur in any part of the organ, neck, body, fundus, or sides, but is most frequent at the posterior and lower part of the uterus, and then at the sides. In Trask's statistics of rupture during labor there were 63 where the injury was of the body and fundus, and 64 of the cervix, involving more or less the body of the uterus and the vagina. Generally there is only a single rupture, but Clarke mentions one instance in which there were sixty lacerations of the posterior wall of the uterus. There may be a simple perforation, but usually the lesion presents greater extent, three inches or more; sometimes it is so great that the uterus is almost completely detached from its vaginal insertion, and again it extends from the inferior segment to the fundus.[2] The rupture may be incomplete or complete; in the former it usually involves the mucous and the muscular coats, and a blood extravasation occurs beneath the peritoneum, but in rarer cases the rupture has been of the peritoneum only. If it occasionally be complete and be large enough the fœtus may pass partially or completely into the abdominal cavity.

Mode of Production.—Duparcque in his well-known work stated

[1] Des Accidents causér par l'Ergot de Seigle dans la Pratique des Accouchments. Paris, 1881.

[2] Nouveau Dictionnaire de Médecine et de Chirurgie Pratique, vol. xxxvii.

as the first of his conclusions that ruptures of the uterus in labor are caused by the contractions of the organ. Trask says, "unless caused by direct violence, rupture must, in almost every case, be the result of the contraction of the uterine fibres, whether the uterus be healthy or diseased." Tyler Smith thus expressed his opinion: "Undoubtedly cases of rupture of the uterus do occur which are dependent upon inflammatory action, either during or before labor, or upon malignant disease of the uterus; but such cases are rare when compared with rupture from self-contraction of the uterus." Jolly's statement is that the true cause is more or less violent uterine contraction, and this acts in two ways, either in compressing the uterine tissue between the head and the bony walls of the pelvis, thus causing inflammation and consecutive gangrene, or else directly by its violence alone.

But the most generally accepted explanation of the majority of cases of uterine rupture is that given by Bandl. During labor the cervix is passive, and becomes stretched as an elastic cylinder by the

FIG. 171.

ILLUSTRATING THE DANGEROUS THINNING OF THE LOWER SEGMENT OF THE UTERUS, OWING TO NON-DESCENT OF THE HEAD IN A CASE OF INTRA-UTERINE HYDROCEPHALUS.

descending fœtal part forced down by uterine contractions; by degrees the cervix is drawn up over the presenting part until finally the latter escapes from the external os. But when the presenting part is obstructed in its progress, because of disproportion between it and the

pelvic canal, the internal os is drawn up higher and excessive thinning of the tissues below occurs, the cervical cavity being greatly distended. Meantime the uterine tissue above the internal os, acting vigorously to overcome the resistance, is left without support from the abdominal muscles and from the *annexæ*, the soft parts connected with the uterus, so that these can no longer fix the organ, holding it in position at the level of the pelvic inlet during a contraction. It thus follows that the greatly thinned cervix whose cavity contains a part of the fœtus is not only greatly stretched, but also often severely compressed between the presenting part of the fœtus and the pelvis, and finally gives way to the unrestrained action of the uterine body.

In Fig. 171 this thinning of the lower uterine segment is shown as occurring in a normal pelvis, but excessive development of the fœtal head is quite plain. A similar condition may be produced when the head is normal and the pelvis narrow, or in a transverse presentation. There is an antagonism between the cervix and body of the uterus; the cavity of the former becomes larger and its walls thinner, while the reverse is the fact as to the latter, and finally with increasing power it overcomes the feebler and diminishing resistance of the cervical walls.

Rupture from Attrition.—According to Naegele, Kilian has chiefly called attention to a deformity of the ilio-pectineal eminence in which this prominence instead of being oval has a spine-like process, and the formation of similar sharp projections, the basin from this cause receiving the designation of *Stachelbecken, pelvis spinosa*, and demonstrated by facts the injurious influence of such deformity in labor. Depaul has stated that four of twenty-four deformed pelves in his collection, show exaggerated developments of particular parts so that a knife-like blade is formed. Generally it is the pubic crest which is affected by this abnormal development, forming a cutting blade; at other times the ilio-pectineal eminence instead of being oval, takes the form of the blade of a veterinary lancet. Such deformity may be upon only one side of the pelvis or upon both. In other instances the body of the pubic is so thinned that its superior margin can be, without exaggeration, compared to a cutting blade. Now it may happen that the uterine tissue forced against these or similar bony projections of the pelvis by contractions will be finally worn so thin that it gives way, and a tear results. Not only this, but it is probable a similar attrition will be caused by an irregular bony surface of the fœtal body, as for example, as is offered by the jagged margin of the imperfect arches in a spina bifida where rupture of the sac has taken place.

Several years ago I had the opportunity of examining a rupture of the uterus, after the patient died, hearing the history of the labor, and also seeing the fœtus. It was a case of pelvic presentation, the child small, and affected with spina bifida; the rupture involved the cervix and the lower third of the body of the womb, and the most rational explanation of the accident was that which has been suggested above.

Symptoms of Rupture.—In a large majority of cases the accident is without premonitory symptoms. Naegele, however, states that

sometimes where the uterine tissue is primarily diseased the rupture is preceded during pregnancy by more or less severe suffering in the affected part. Generally, however, there is no warning of the disaster, but during a pain of unusual severity, or an obstetric manipulation, as the introduction of the hand for the purpose of version, the patient has sudden suffering of the greatest intensity, "totally different from the pain of uterine contraction." Trask says that she is conscious of something having given way within her—"she feels a tearing or rending sensation, and in some instances the noise accompanying the rupture is heard by those around her." The last statement is now generally denied; Depaul regarded it as purely theoretical. The patient's face becomes anxious and pale, the skin is covered with cold sweat, there are nausea and vomiting, the pulse is rapid, thread-like, and irregular, the respiration is hurried, difficult and sighing, the sight is obscured, and there is ringing in the ears. There is severe pain in the abdomen, and the latter notably changes its form if the fœtus has entirely or partially entered its cavity, or if there be large hemorrhage in it. The uterine contractions cease in almost all cases. Upon vaginal examination generally some hemorrhage is discovered, the presenting part has receded, or is replaced by another presentation, and possibly the rent can be at once felt. In the 580 cases studied by Jolly the symptoms narrated were manifested as follows:—

Abrupt cessation of contractions was observed in	218	cases.
Gradual " " " " " "	38	"
Change in the pulse was observed in	179	"
Prostration was observed in	151	"
External hemorrhage, slight in 33, was observed in	148	"
Retrocession of presenting part was observed in	146	"
Abdominal pain was observed in	133	"
Alteration of countenance was observed in	115	"
Fœtal parts felt immediately under abdom. wall was observed in	77	"
Acute pain at the moment of rupture was observed in	62	"

These are the signs almost always presented, but others which may occur should not be neglected. Thus a remarkable change in the form of the abdomen is observed—two tumors, one formed by the escaped fœtus and the other by the uterus, may be present. In some cases the movements of the fœtus that have been active suddenly cease, and the sounds of its heart can no longer be heard. Hemorrhage may be external, internal, or both; Charpentier directs attention to the fact that the blood may accumulate at a particular point, forming a hypogastric tumor. Kiwisch, M'Clintock, Montgomery, Paully, Ross, Crighton, and Schatz have indicated as a pathognomonic phenomenon the occurrence of emphysema at the level of the hypogastric region, very rapidly sometimes, and which results from the penetration of air through the rent and its diffusion in the connective tissue.

Trask makes the diagnostic marks two, recession of the presenting part, and the ability to distinguish the limbs of the fœtus beneath the abdominal parietes. In regard to the cessation of the uterine contractions, Jolly found 37 in which this did not occur, or was only temporary, and in some, indeed, the contractions retained their

normal force. There may be a rupture of the womb, and a fatal issue result without the slightest suspicion of the accident during life, and it is first revealed at the autopsy. Hervieux gives a case from the practice of Dubois, in which he performed podalic version because of narrow inlet, and delivered; the patient died the next day without having manifested any symptom of uterine rupture, yet upon the post mortem there was found an irregular rent involving a part of the anterior face of the vagina, the entire length of the neck in front, and a portion of the left side of the uterus. He also reports one from his service in the Maternity, the report being made by Jolly, in which Tarnier, by external manœuvres, changed a pelvic into a vertex presentation; the woman was delivered on the 9th of November and died on the 11th. At the autopsy there was found a rent in the left side of the neck, a little more than two inches long, extending from the internal os to the union between the neck and the vagina. In a paper[1] read before the Philadelphia County Medical Society, I narrated the history of a patient in whom a rent in the uterus occurred that did not present any symptoms. The patient was a multipara, and had been in labor twelve hours when I was called to her, in consequence of there being a shoulder presentation—the left shoulder. Ether was immediately given until she was thoroughly under its anæsthetic effect, then without violence, and with ease, I passed two fingers of the left hand behind the right knee, brought the foot down, and turning and delivery were readily accomplished in a few minutes; the child was dead, the placenta was delivered without trouble, and the uterus was well contracted. The patient made no great complaint after coming from under the anæsthetic; there was no considerable flow of blood, the pulse was good, no irritability of the stomach, in short there was not anything that led me to suspect serious injury of the uterus. In six days the patient was dead from septicæmia—there were several other cases of this disease in the hospital at the time, two of which also proved fatal—the autopsy showed a tear beginning at the external os, extending the entire length of the cervix, and involving the lower fourth of the left side of the uterus.

Prognosis.—This is most unfavorable both for the mother and for the child—especially for the latter. In Jolly's 580 cases only 100 mothers were saved; Ramsbotham in 237 children found only 20 saved. The mother may die very suddenly from shock, as in a patient of Churchill,[2] who lived but five minutes after the accident, or one of Bluff,[3] who gave a scream of suffering agony, vomited, and died. Instead of sudden death from shock, there may be rapid death from hemorrhage; or a fatal result may occur from strangulation of a coil of intestine in the rent; but the most frequent cause of a fatal termination is septicæmia.

Treatment.—The practitioner will guard against this grave accident by early removal of the obstacle which prevents delivery, as, for

[1] Report of the Obstetric Department of the Philadelphia Hospital for the quarter ending April 30, 1884. Philadelphia Medical Times, August 23, 1884.

[2] Diseases of Women. [3] Siebold's Journal, 1835.

example, by puncture of a hydrocephalic head, or by performing version in case of shoulder presentation. In the latter condition, however, it may be his manipulation, no matter how gently done, that precipitates the injury; as it is the last straw that breaks the camel's back, so it is the last additional stretching necessary for the introduction of even one or two fingers into the cervical cavity that causes this greatly distended part to give way. Here are his Scylla and Charybdis, for the rupture may occur should he delay, or should he act, spontaneous in the one case and traumatic in the other. Yet under these circumstances the rule is imperative that he must run the risk of prompt, intelligent, and skilful action, rather than that of procrastination.

The two immediate indications are to rally the patient from her prostration, and deliver as soon as possible. The question as to the mode of delivery would seem to have been determined by the statistics of Trask, 1856, and of Jolly, 1870. Those of the former show that, including cases where the head and the whole or part of the body had escaped into the peritoneal cavity, and those in which the pelvis was contracted, the following were the results:—

Gastrotomy . . .	Saved 22	Lost 7	or 24 per cent.
Perforation, turning, etc. .	" 38	" 80	" 68 "
Abandoned . . .	" 15	" 55	" 78 "

The statistics of Jolly are as follows:—

	Died.	Cured.	Per cent.
Undelivered, 144	142	2	1.45
Forceps, 115	101	14	12
Version, 214	165	47	23
Method not indicated, 53 . . .	44	9	17
Gastrotomy, 38	12	26	68.4

When the abdomen is opened of course the peritoneal cavity must be thoroughly cleansed after the removal of the fœtus and the placenta, if they are in it, and the wound of the uterus closed by sutures. But it does not follow that abdominal section should be made in all cases of uterine rupture when the fœtus can be readily delivered through the natural passage, but only those in which there has been hemorrhage or escape of amniotic fluid into the abdominal cavity; even in the latter good results have been had in some cases by washing out the peritoneal cavity through the rent with an antiseptic fluid, and securing drainage. Fleischman[1] has recently shown the greater mortality of ruptures of the anterior portion of the cervix than of the posterior, for of 18 cases of the former all died, while of 14 of the latter only 9 were fatal, and he suggests that in the former injury the abdomen should be opened, while in the latter drainage should be used. Douglas's cul-de-sac presents favorable conditions for drainage, while the vesico-uterine does not. In one case successfully treated by drainage the abdominal cavity was washed out with a one per cent. thymol solution, and a firm drainage-tube passed posteriorly into the cavity, and retained in position by a loose tampon of iodoform gauze.

[1] Ein Beitrag zur Casuistik der Collumdehnung und der Uterusruptur, Zeitschrift für Heilkunde, 1885.

Uterine Hemorrhage in the Third Stage of Labor, and in the Puerperal State.—Uterine hemorrhage in placenta prævia, and also that which occurs in normal implantation, but from premature detachment of the placenta, have been considered, and there are yet to be presented those varieties of the disorder which may happen in the third stage of labor, and in the puerperal state. It should be remembered that the flow of blood, however swift the death it may bring, is not itself a disease, but only a symptom, and that our therapeutics will be most wisely directed to the prevention, or to the removal of the cause.

I. *Hemorrhage from the Uterus in the Third Stage of Labor.*—It is convenient in this connection to study the entire pathology of the third stage of labor, that is, the failure of the uterus to expel the placenta, whether the retention of the latter be attended with instant hemorrhage or not, for as long as the placenta remains undelivered this accident is threatened. In studying the normal course of this stage it was found that uterine retraction detached the placenta by lessening the surface of implantation, and then uterine contractions expelled it, these contractions usually occurring from five to fifteen minutes after the delivery of the child. Failure may occur in either of these processes, that is, the placenta may not be detached, or be only partially detached in the usual time, or having been separated from the uterine wall it is not expelled from the uterine cavity, and these different conditions and their consequences must be considered.

1. The placenta is still attached, or only partially detached. In the first case there is no hemorrhage, but there is in the second. The cause of this failure in the complete separation of the placenta is generally want of uterine action, and the condition of the organ is said to be that of atony. Atony of the uterus is liable to occur when the organ has been greatly distended, as from plural pregnancy, or from polyhydramnios; again, it may be manifested as the consequence of protracted labor, the uterus having become exhausted by its long-continued work, and, on the other hand, very rapid emptying of the uterus may be followed by relaxation, especially if a supporting abdominal pressure is not used; atony is not unusual in multiparæ who have had several pregnancies at brief intervals. Where the detachment has not even partially occurred, there is no hemorrhage, and as there is no demand for immediate active intervention, we may confine our treatment to an endeavor to revive the general forces of the patient, and gentle frictions of the uterus to awaken its activity, at the same time exercising the most watchful care lest a worse condition come. But if there be hemorrhage there is not a minute to spare, the placenta must be completely detached, expelled from the organ, and uniform uterine retraction secured; the special means by which these ends are secured will be considered hereafter.

2. But in very rare instances the union between the placenta is pathological; there have been, according to Hegar, inflammation of the uterus, endometritis, placentitis, transformation of apoplectic placental effusions, and fibrous degeneration of the elements which normally unite the placenta and the uterus. Now in all cases of adherence

of the placenta to the uterus if the separation can be effected by evoking uterine action so much the better, and to this end compression and friction of the organ are to be employed. But in a few cases the connection must be destroyed by direct action, and to this end, other means having failed, the disinfected hand must be carried into the uterus, the other hand sustaining the organ through the abdominal wall, the placental margin, especially that where the detachment has begun, sought, and the ends of the fingers insinuated between the two, breaking or even cutting with the nails the adhesions. The classic direction to use the fingers as a paper-cutter is used to cut the leaves of a book seems very easy in print, but is by no means easy in performance. It is important to keep the placenta entire, and not tear it away in fragments; its removal when adherent is at once one of the most delicate, difficult, and dangerous of obstetric operations, and should never be undertaken without the indications are clear.

The introduction of the hand is not without danger of immediate injury to the uterus. Barker[1] has stated that the cases are rare in which it will be found necessary to introduce the hand into the cavity of the uterus except where hemorrhage is associated with a partially adherent placenta; further, the same authority holds that traumatic injuries followed by serious consequences have resulted from such introduction. The operation itself may cause more or less traumatism of the uterine wall. It is said by some there is no danger of infection if the hand be aseptic; but it should be remembered that the introduction of the hand opens the way for the entrance of air, and thus infectious germs may find access to the uterine cavity.

Siredey, in referring to the direct removal of an adherent placenta, says[2] that in opening new vessels and increasing by the tearing the uterine wound, it necessarily makes the hemorrhage greater. Still more, the deliverance is inevitably incomplete, and fragments of the membranes which with clots remain in the uterine cavity, are susceptible of rapid change and thus favor the development of germs. Hence we do not hesitate to proscribe this practice as being often inefficacious and dangerous. If complete deliverance is possible it ought to be made, but if the placenta is adherent and resistant, contrary to the classic opinion, we think it would be much better to resort to ergot given in large doses at short intervals in order to determine as promptly as possible energetic uterine contractions which stop the hemorrhage, and thus cause disappearance of immediate danger.

If after having removed the placenta we find upon carefully examining it any large fragment missing, the hand must be reintroduced into the uterus, and the remaining part sought. An injection of hot carbolized water should follow the manual removal of the placenta.

3. The placenta is not delivered because of general or local spasmodic contraction of the uterus. General contraction is often seen as a consequence of the injudicious use of ergot; by this contraction the cavity and the cervix are separated into two cavities, the narrowed internal os marking the boundary between them, and from the form which the organ takes Guillemot gave the contraction the name of hour-glass, a designation still generally used. The placenta

[1] Transactions of the American Gynecological Society, vol. iii. page 157.
[2] Les Maladies Puerperales, Paris, 1884.

is said to be incarcerated, it is shut up in the prison formed by the upper part of the uterus. Kleinwächter's view as to this being a physiological, not a pathological condition, has been presented on page 447. Many obstetricians hold that there is no other form of hour-glass contraction, that is, the narrowing is always at the internal os; certainly it is the most frequent, but trustworthy observers have found similar narrowing at other parts of the body of the uterus. The incarceration, either when the contraction is at the internal os or higher, may be complete or partial, that is, the entire placenta may be shut up, only the cord hanging out, or part of it may protrude through the narrow canal. However, these conditions do not make the treatment differ. If there be time to wait, relaxation will follow the spasmodic contraction, and then it may happen that the placenta will be spontaneously expelled, or the hand may be introduced without difficulty for its removal. There is time to wait if no hemorrhage occurs, and we may hasten the relaxation by a rectal injection of laudanum or chloral. On the other hand, hemorrhage may not permit delay, and then while anæsthetic inhalation is employed, the practitioner introducing his hand into the vagina, first one, then two, three, and four fingers, and finally the entire hand will be passed through the stricture, and the resistance gradually overcome, until he can grasp the placenta and remove it. Whenever it is necessary in this or in other cases to remove the placenta from the uterine cavity, it is best not to withdraw the hand until uterine contraction is secured; indeed, it is well if the hand be not withdrawn by voluntary act, but expelled by the action of the uterus.

4. *Hemorrhage from the Uterus after Labor.*—This hemorrhage may be primary or secondary. The boundary line between these is arbitrary, and hence authors differ as to where it should be placed; adopting that given by McClintock and Barker, a hemorrhage taking place within six hours after labor will be called primary, and that secondary which is manifested after the first six hours and within the month.

A. *Primary Hemorrhage.*—This may occur immediately after the delivery of the placenta; its appearance is usually not delayed beyond the first hour. The hemorrhage may be open or concealed, but in most the two forms are combined.

Causes.—In some instances the flow of blood depends upon a neoplasm, as, for example, a fibrous tumor which prevents uniform retraction of the uterus, upon a tear or rupture of the organ, upon inversion, upon albuminuria—Blot found in forty-one cases of this affection twelve of post-partum hemorrhage—upon a constitutional predisposition which is thus manifested in successive labors, and especially upon uterine inertia, either with or independently of any deranged condition of the blood, or predisposition to hemorrhage. Inertia of the uterus may be manifested after a rapid or after a tedious labor; or after great distension of the uterus (see remarks upon deficiency of uterine force, page 439); it may be connected with general feebleness of constitution, or imperfect development of the muscular tissue of the uterus. Lacerations of the neck may be the cause of hemorrhage, acccording to most, from the torn vessels, but Delore explains the flow as resulting from the failure of a *point d'appui* given by the neck to the intra-uterine

clot necessary to hæmostasis. Schroeder refers to a very dangerous variety of uterine hemorrhage in those cases where, though the rest of the uterus is normally contracted, the place of placental insertion does not participate in the contraction. In this paralysis of the placental site the part involved is driven down into the cavity of the uterus by the uterine parenchyma, which is contracted round it like a ring so that there is formed a sort of a tumor that projects within the uterus, and at the corresponding point of descent a depression may be felt externally.

Symptoms.—There is generally observed an unusual frequency of the pulse, but this increase is possibly only slight, nevertheless its occurrence should put the practitioner upon his guard even though he finds the uterus at the time normal in size and in firmness. The patient probably complains of great thirst, and she is somewhat restless. But often without any premonitory symptoms the flow of blood can suddenly be manifest, trickling through or down by the side of the bed to the floor; the discharge may be so rapid and great that it is appropriately called flooding, a flood upon which the patient's life is swiftly borne away unless proper measures are promptly used; now she is usually restless, and her arms rise and fall, thrown to this side and to that in a sort of aimless way and agony of despair, her respiration is sighing and she wants fresh air, and possibly she complains of the darkness of the room, exclaiming "I can't see!" while a death-like pallor is upon her face. You put your finger upon her pulse, it is frequent, thready, intermittent, your hand upon her abdomen, and the small hard uterine globe is no longer felt, but there is excessive abdominal distension, and it is often difficult or impossible to define the boundaries of the uterus—a relaxed sac filled with blood.

Treatment.—There is not a minute to lose when symptoms such as those briefly sketched are present, and yet everything must be done calmly, without hurry, and without excitement, and the practitioner will have the supreme pleasure in almost all cases of snatching a human life from death just when that life is dearest and has received its highest consecration. Let the head be instantly lowered by taking away pillow or bolster upon which it is resting, and by putting bricks or books under the feet of the bedstead. Immediately compress the uterus with one hand upon the abdomen, and the other introduce into its cavity; the two hands thus employed will usually excite uterine contraction; if the prostration be excessive, the hypodermatic use of sulphuric ether is indicated; ergot can also be similarly given. If contractions of the uterus are not evoked, it should be compressed between the hands, either the external hand being placed behind it, and the internal in the anterior vaginal cul-de-sac, or the latter may be in the posterior cul-de-sac, and the former upon the anterior wall of the uterus.

Compression of the aorta can be made with the fingers of the left hand, the practitioner being upon the patient's right side; the abdominal wall is depressed just above the uterus and a little to the left of the median line until the pulsations of the aorta are felt, then slight pressure with the first three fingers will arrest the current.

Compression of the abdominal aorta in post-partum hemorrhage was probably first advocated by Rüdiger, an obstetrician of Tübingen, in 1797. His method was by the hand introduced into the uterus, pressing through its posterior wall upon the vessel. Ulsamer, in 1825, made known the method of compression through the abdomen; Siebold, in 1828, strongly endorsed it from his personal experience, and Baudelocque was its warm advocate. Barnes regards it as only a momentary resource; yet it has been continued for hours and been successful. Gros[1] has given nine cases of puerperal hemorrhage in which it was successfully employed. These successes are sufficient answer to the theoretical arguments adduced against it, especially by Jacquemier. The practitioner will need at least one assistant to relieve him, for the hand becomes too weary after twenty or thirty minutes to continue efficient compression without a rest.

Injections and Applications to the Interior of the Uterus.—Barnes[2] has been the especial advocate of injecting into the uterus a solution of one of the salts of iron, half an ounce of solid perchloride or persulphate in ten ounces of water. He claims that the hæmostatic effect of the iron is produced in three ways: First, there is its direct action in coagulating the blood in the mouths of the vessels; secondly, it acts as a powerful astringent on the inner membrane of the womb, strongly corrugating the surface, and thus constringing the mouths of the vessels; thirdly, it often produces some amount of contractile action of the muscular wall. Instead of using a solution of one of the iron salts as an injection, Wynn Williams[3] applies it by means of a sponge to the interior of the uterus; some of the tincture of the perchloride of iron is poured into a sponge, which is then passed into the hollow of the hand already in the uterus, previously emptied of clots, and the sides of the uterus well sponged over.

Winckel[4] states that on one occasion where there was a tremendous flooding, which could not be checked, immediately after the removal of a myxoma of the chorion weighing five or six pounds, he resorted to the introduction of a cylindrical wad of cotton-wool, two inches long and half an inch thick, soaked in thirty grams of the liquor ferri sesquichloridi: he mentions that this plan was used by Schreier as early as 1854. Hervieux[5] strongly recommends the iron injection by means of a double catheter; he employs the following formula:—

Chloride of sodium	15 parts.
Solution of perchloride of iron	25 "
Distilled water	60 "

This is the solution of Piazza as modified by Adrian. For use it is diluted with five parts of water.

Dupierris,[6] of Havana, in 1857, published three cases of severe post-partum hemorrhage successfully treated by injecting into the uterus a mixture of one part of tincture of iodine and two of water. Breslau,[7] of Munich, 1858, seems to have been the first to inject the uterus with solu-

1 De la Compression de l'Aorte dans les Hémorrhagies graves apres l'Accouchement.
2 Obstetric Operations.
3 London Obstetrical Society's Transactions, vol. xi., 1870.
4 Op. cit.
5 Op. cit.
6 North American Medico-Chirurgical Review, 1857.
7 Hervieux, op. cit.

tion of the sesquichloride of iron, diluted with an equal quantity of water, in the treatment of post-partum hemorrhage; the success was complete.

In recent years the injection of water at a temperature of 110° F. has had such marked beneficial results that this remedy seems to have superseded all other injections for the arrest of post-partum hemorrhage; even Barnes advises using it before resorting to the iron salt injection, only employing the latter if the former fails. Penrose[1] has great confidence in vinegar as the best remedy for post-partum hemorrhage from uterine inertia. He states that he has been using it alone as his last resort, both in hospital and private practice in many apparently desperate cases of post-partum hemorrhage, and invariably with successful results. He gives the following as his method of applying it: "I pour a few tablespoonfuls into a vessel, dip into it some clean rag or a clean pocket-handkerchief. I then carry the saturated rag with my hand into the cavity of the uterus and squeeze it; the effect of the vinegar flowing over the sides of the cavity of the uterus is magical. The relaxed and flabby uterine muscle instantly responds."

The first application of vinegar to the interior of the uterus for hemorrhage is probably to be attributed to Leroux,[2] 1776. He stated that the most certain way of arresting this hemorrhage was by pieces of linen or tow dipped in pure vinegar, and then placing them in the vagina, and sometimes in the womb: he claimed that vinegar was both antiputrid and antiphlogistic. Velpeau[3] mentions that Saxtorph advised injection of oxycrate of pure vinegar, and of ice-water. From Ingleby[4] we learn that Cruikshank used a sponge dipped in lemon-juice or vinegar, then passed into the womb.

Quite recently Betz[5] has succeeded in arresting post-partum hemorrhage by introducing into the uterus a sponge upon which chloroform has been poured. Chéron states that the chloroform acts by a powerful excitement of the walls of the vessels, either directly or through the vaso-motors, and that its action is incomparably more energetic than that of a sponge saturated with vinegar.

Application of Cold, etc.—Rigby has spoken favorably of suddenly flapping a cold, wet napkin upon the abdomen, and Gooch mentions a case of post-partum hemorrhage where he had unsuccessfully applied ice to the abdomen, he "swept it off, and taking a ewer of cold water, let its contents fall from a height of several feet upon the belly; the effect was instantaneous; the uterus, which, the moment before had been so soft and indistinct as not to be felt within the abdomen, became small and hard; the bleeding stopped, and the faintness ceased—a striking proof of the important principle that cold applied with a shock is a more powerful means of producing contraction of the uterus than a greater degree of cold without the shock." According to Dr. Rigby, Dr. Young, in his lectures, University of Edinburgh, directed

[1] Transactions of the American Gynecological Society, vol. iii.
[2] Observations sur les pertes du Sang des Femmes en Couches.
[3] Traité complet de l'Art des Accouchements, 2d edition, 1835.
[4] Uterine Hemorrhage.
[5] Revue Médico-Chirurgicale des Maladies des Femmes. August, 1886.

ten or twelve injections of cold water in the uterus. Playfair speaks favorably of ice introduced into the uterus, and also of applying a piece, with occasional intermissions, over its fundus. Probably when the application of cold does not at once awaken uterine contractility, its continuous use will do no good, and may produce greater prostration; hot-water injections have been so generally successful they should be preferred.

Faradization of the uterus has been successfully used for the arrest of hemorrhage; but the apparatus is rarely at hand, nor can it usually be procured soon enough for use in case of post-partum hemorrhage.

Intra-venous injection of blood or of milk, or a solution of common salt, and intra-peritoneal injection of defibrinated blood are among the means advised for the restoration of patients exhausted by hemorrhage, and in some cases have been successfully used. Auto-transfusion by means of bandages applied to the lower limbs, causing such compression as to force the blood out of them and thus increase the supply to the heart and brain, have also been successfully employed.

After-treatment.—Playfair wisely says that the best restorative which can be employed is opium. Its use in uterine hemorrhage was fully recognized by Hoffman, if not before his time. It relieves spasmodic uterine contraction, sustains an exhausted nervous system, and secures rest. Collins[1] gave it with a free hand, stating that he never saw any injurious effects from thirty to forty drops of the tincture administered every twenty or thirty minutes, and continued until one hundred and fifty to two hundred had been given. Barnes directs thirty or forty drops of Battley's solution once in two or three hours. Alcoholic stimulants may be required; fluid nourishment should be given at frequent intervals, beginning with small quantities lest the stomach reject it, and if it does, then nutrient enemata are to be used.

It should be remembered by the practitioner that almost all cases of post-partum hemorrhage might be prevented by proper treatment, either during pregnancy, or in labor. Penrose has given the proportion of preventible ones as ninety-nine out of one hundred.

B. *Secondary Hemorrhage.*—We may have the same causes of secondary as of primary hemorrhage, but uterine inertia is rare after the first twenty-four hours, and the most frequent factor in the production of the disorder is a retained fragment of the placenta, or of the membranes, or a placenta succenturiata. Barker remarks that the retention of fragments of the placenta is an accident that has happened in the hands of some of the ablest and most eminent obstetricians.

Schroeder states that most frequently placental débris remain in the uterus after artificial detachment of the placenta. Nevertheless this may occur when the placenta escapes spontaneously. Thus Stadfelt relates that in seventy autopsies of women dying in childbed, there were found in seven placental fragments varying in size from that of a hazel-nut to that of an egg, and yet in five of the seven the delivery of the placenta was spontaneous.

[1] Practical Treatise on Midwifery.

A placenta succenturiata may be present, and no professional ability of course can make the diagnosis until after its expulsion. While, as stated by McClintock,[1] a coagulum of any size is not apt to be found in the womb beyond the first few hours after delivery, as a very moderate degree of uterine action would be sufficient to expel it or to prevent its formation, yet should it be present there is a constant risk of hemorrhage as long as it remains in utero. Contamin[2] found a coagulum thus retained the cause of secondary hemorrhage in six out of fifty-six cases.

The following report furnished by my friend Dr. Allison Maxwell is a striking illustration of fatal hemorrhage from this cause several days after delivery.

Mrs. B., aged twenty six, primipara, was confined August 7, 1880. The patient was a strong, healthy woman of German extraction. The labor-pains began about twelve o'clock, noon, and twelve hours after a healthy male child was born. The position was L. O. A., and the labor was natural. After the umbilical cord was severed the placenta was found in the vagina, and was removed without much difficulty. I examined carefully and found the placenta intact, but was not so positive about the membranes, as they were somewhat ragged, but I did not consider it necessary to introduce my fingers into the uterus, as there was but little hemorrhage and the uterus could be felt, a hardened ball the size of a child's head, through the abdominal walls.

Everything went on naturally, except there was no lochial discharge, save a slight colorless fluid. A firm coagulum could be felt obstructing the os uteri, but could not be reached and broken up with the finger. The uterus for the first five days did not appear to diminish any in size. On the afternoon of the fifth day an offensive sanguineous discharge began to flow, and some small clots were expelled during the night, showing that the coagulum which had occupied the womb for five days was disintegrating. Up to this time a vaginal injection of carbolized water had been used night and morning. The morning of the sixth day the patient nursed her baby, looked cheerful, and was apparently doing well; pulse 80, temperature 99½°. The lochia still continuing very offensive, I used the double catheter and washed out the uterus with a weak solution of carbolic acid and water, and just as I concluded the injection the uterus contracted firmly and ejected the water out of its cavity and on to the floor. Almost immediately the patient had a chill, lasting half an hour, but the uterus during this time remained firmly contracted, and there was no sign of internal or external hemorrhage. At this time I left the house, and two or three hours afterward hemorrhage must have begun, for when I was summoned at 3 P. M. the bedding was saturated with blood, the uterus completely relaxed, so that no uterine globe could be felt; and the patient, pulseless and *in articulo mortis*, died within ten minutes. Immediately after the delivery of the placenta she was given a half drachm of Wyeth's fluid extract of ergot, and the dose was twice repeated the next day. On the day of the fatal hemorrhage, soon after the chill, fearing hemorrhage, I gave her one drachm of the fluid extract of ergot.

Placental fragments may be the centres around which concretions of blood take place, and thus form fibrinous polypi, which are the

[1] Clinical Memoirs on Diseases of Women. [2] Étude sur les Hemorrhagies.

cause of hemorrhage that continues until they are removed. Hewitt[1] has reported a case of fatal hemorrhage in the sixth week after delivery from a traumatic aneurism of the uterine artery.

Johnson and Sinclair[2] have reported a case of fatal hemorrhage from rupture of a uterine thrombus on the fourth day after delivery.

Barker gives a striking instance of metrorrhagia twenty-four hours after labor, caused by a husband's brutal remark; he states that he had never seen a patient recover from so fearful a hemorrhage. Duhamel mentions a case where a mental cause produced dangerous metrorrhagia on the tenth day. The patient had been getting on well, and was just rising to have her bed made, when some acute mental influence brought on the flow, the uterus rapidly filling so as to reach the umbilicus. Cold, ergot, and astringents were vainly used; but, finally, four or five hours' continued compression of the aorta permanently arrested the hemorrhage.

The following report, furnished me by Dr. Voorhees, one of the resident physicians of the obstetric department of the Philadelphia Hospital, of a patient under my care, illustrates the fact that severe secondary hemorrhage arising from a mental cause may occur even as late as the eleventh day:—

A. A., German, single, primipara; labor at term, and lasted a little more than twelve hours. Her condition was perfectly satisfactory up to the evening of the eleventh day after confinement; on that day she was transferred to the convalescent ward, and then saw the out-door agent as to keeping the father of the child in prison for refusing support. She was greatly distressed by this interview, and at 4.30 the next morning hemorrhage began. Digital examination showed that the blood came from the uterus; the os was high up, flabby, and full of clots; the uterus was as large as if delivery had just occurred, and was soft and relaxed. Ergot was given, the child was applied to the breast, the uterus was emptied of its clots, and friction used to stimulate contraction, but the bleeding still continued. Ice was then applied to the abdomen, and also introduced into the vagina; the bleeding was not stopped. Hot water was then thrown freely into the uterus, and the result was prompt and satisfactory. The patient made a good recovery. Although the uterine discharges were carefully examined, at no time was there any organized material found, nothing in the least indicating, for example, that this hemorrhage was caused by the retention of a placental fragment.

Even where mental disturbance is not the sole cause of the metrorrhagia, it is in many cases an associated factor. Thus Winckel observes that violent physical exertion, combined with the dread of an examination, were the causes of the bleeding in many cases. Sexual intercourse is in some, it is to be hoped in very few, the cause of hemorrhage. McClintock has stated that among the out-patients of the Lying-in Hospital he has known secondary hemorrhage brought on by sexual intercourse eight or ten days after parturition.

In this relation, too, may be mentioned cases of secondary hemorrhage, referred to by Charpentier, produced solely by the return of the

[1] London Obstetrical Society's Transactions, vol. ix.
[2] Practical Midwifery.

wife to the husband's bed even when no intercourse occurs, "the simple presence of the husband causing an erethism and nervous excitement which resulted in the flow." Charpentier also calls attention to the fact, occasionally observed, that nursing may produce in some uterine irritation, which results in hemorrhage.

Treatment.—But few words are to be said upon this topic, for many patients will require the same treatment as has been detailed in the consideration of primary puerperal metrorrhagia. If a displacement of the uterus be the cause, as it is in some, of course that must be corrected; if there be probably a placental fragment, or fibrinous polypus in the uterus, it must be removed; this removal may require, perhaps, previous dilatation of the os; an antiseptic injection should be used after the operation. The internal administration of ergot for some days will often be useful. A clot which arrests the normal lochial flow, as in the case that has been detailed, should be broken up and removed. Delore remarks:—

> We are in general decidedly opposed to removing clots, a manœuvre which seems to us useless and dangerous; useless, because if the clot be removed another is immediately formed; dangerous, because the introduction of the hand or instruments into the uterus may convey bacteria. Nevertheless, when one recognizes on the third or fourth day the presence of large clots, of which the uterus is powerless to free itself, it is necessary to remove them if one can; Pajot's curette was designed for this purpose.

In the after-treatment tonics, especially iron, and abundant nutritious food are indicated for the restoration of the blood. It should be remembered that in all cases of puerperal uterine hemorrhage there is thereby caused a greater liability to acute puerperal diseases; this liability, too, is increased by the local treatment the hemorrhage may render necessary.

Inversion of the Uterus.—By inversion in general we understand a reversed position. Thus, a cone is inverted when it rests upon its apex instead of upon its base. So, too, the inverted uterus has its fundus below, while the os is above; but in order that this change of position may be possible its external or serous covering must become internal, and the mucous lining its investment; the entire changes which the word inversion, as applied to the uterus, includes, may be briefly summed up in the statement that the organ is upside-down and wrong-side out.

Denuce[1] has conclusively shown that this accident, the gravest of all positional disorders of the uterus, was known to Galen, and even to Hippocrates. The accident is not frequent, for, as observed by West, taking the annals of the Dublin Lying-in Hospital and the London Maternity Charity, it was not met with in a total of more than 140,000 labors. Out of 400 cases Crosse[2] found only 50 that occurred independently of pregnancy. Almost all that result from the pregnant condition are manifested at the end of gestation, yet a few have happened after miscarriage.

[1] Traité Clinique de l'Inversion Utérine.
[2] Essay upon Uterine Inversion: Transactions of the Prov. Med. and Surg. Association.

The causes of inversion of the uterus are pulling upon the cord when the placenta is attached in the upper part of the uterus, pressure upon the fundus, and the action of the uterus itself. Denuce states that premature or too prolonged tractions made to hasten the detachment of the placenta, tractions too energetic or badly directed to overcome adhesions, when these are present, are in general, and especially in inexperienced hands, the most frequent cause of uterine inversion. Siredey and Danlos refer to untimely tractions as having been several times, and are most frequently, perhaps, the origin of the accident. These opinions are quoted because some writers have given greater importance to spontaneous inversion than seems justifiable by facts. Independently of tractions exerted in the way mentioned, a like effect may result from the cord being abnormally short, or from delivery taking place when the mother is standing, the infant falling to the floor, in the fall acting as a weight suspended by the cord to the uterine wall. Cases illustrating each of these ways in which the displacement may be produced have been published. It should be remembered, however, that such traction cannot cause inversion unless the uterus be relaxed.

But inversion may result from abdominal pressure, and also from uterine contractions, and hence the accident be entirely spontaneous. In the event that abdominal contractions are strong and the uterus relaxed at the expulsion of the child, the uterine walls are depressed, and into the cavity thus formed the intestines are forced, and the depression increased until more or less complete inversion of the organ results. Uterine inertia, then, with activity of the abdominal contractions, explains some cases of spontaneous inversion of the uterus. Active contraction of the fundus and relaxation of the neck are by some regarded as causes when the accident is spontaneous. Again, it is held that paralysis of the upper portion of the uterus assisted by the weight of the adherent placenta, permits or promotes the dropping down of this portion into the rest of the uterine cavity, an invagination occurs, and then this invaginated part is as a foreign body to the active portion of the uterus, which immediately contracts, forces it still farther down, and the inversion is completed.

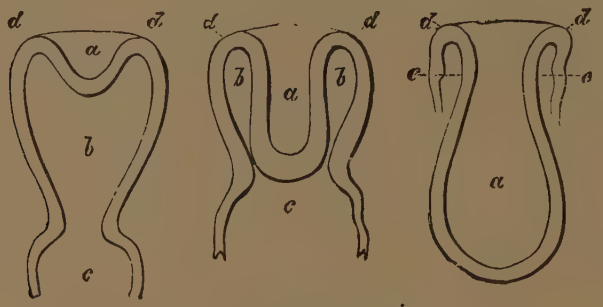
In rare instances it appears that inversion may begin at the cervix, a view that has been especially upheld by Dr. Isaac E. Taylor. So, too, while inversion generally occurs at or immediately after delivery, it may happen some hours or days after. Again, it is possible for an inversion to take place "without sufficient symptoms to attract attention or to indicate that anything has gone wrong." (See paper by Dr. J. C. Reeve, entitled Moot Points in regard to Inversion of the Uterus.[1])

Degrees of Inversion.—The following illustrations from Crosse show different degrees of inversion of the uterus. In the first there is simple depression or cupping of the fundus; in the second, the fundus has descended until it is at the os, and in the third the inversion is complete.

[1] Transactions of the American Gynecological Society, vol. ix.

Diagnosis.—We are here concerned only with acute inversion of the uterus occurring in labor; the diagnosis of chronic inversion, or that which results from the descent and expulsion of a fibroid polypus originating in the upper part of the womb, belongs to gynecology rather than to obstetrics.

FIG. 172.



THREE DEGREES OF INVERSION.

Symptoms and Diagnosis.—The three striking symptoms resulting from acute inversion of the uterus are pain, shock, and hemorrhage; the last, however, in case the placenta is only partially detached, may not be great, according to Radford. At the same time that these symptoms happen there will be found protruding from the vulva or in the vagina a large, soft, pyriform, or somewhat globular tumor, and the tumor formed by the uterus in the hypogastrium cannot be felt as in the normal condition. The placenta may be attached to the tumor found in the vagina or at the vulva, and if it is, the diagnosis is still easier, and more simple.

While it is hardly possible to commit an error in the diagnosis when one is present at the accident, yet, after the lapse of twenty-four or forty-eight hours, difficulties may arise, especially as one of the means by which an inverted uterus may be distinguished from a polypus, the former being sensitive, while there is entire absence of sensibility in the latter, may fail. For example, a woman twenty-four hours after labor has a pyriform tumor in the vagina, the tumor not being more than one-third larger than the uterus in chronic inversion; an ovoidal elastic tumor is felt in the abdomen, reaching as high as the umbilicus, pressure upon which causes the escape of clots and fluid blood from the vagina, and upon inquiry it is stated that the urine has been freely discharged. The vaginal tumor is insensitive both to touch and to puncture with an exploring needle, while the introduction of the hand into the vagina gives much pain, which becomes so great when an effort is made to pass it up high enough to reach the point of implantation of the polypus, or of the cervical ring, if there be an inversion of the uterus, that the effort is desisted from, the patient's very prostrate condition forbidding the use of an anæsthetic. Yet in this case the uterus was inverted, the abdominal tumor being the greatly distended bladder. The moral of this brief history is, that in making a diagnosis of acute uterine inversion, it is all important to know by the use of a catheter that the bladder is empty, and not to trust to the absence of sensibility in the tumor as a proof that there is not an inverted uterus.

Still another illustration: Some years ago a physician brought his wife to Louisville (Kentucky), on account of a large tumor that had occupied the vagina for several months. All the gentlemen who examined the case agreed, with one exception, that the tumor was a fibrous uterine polypus; the gentleman who differed, a physician of considerable experience and reputation as a gynecologist, gave a very positive opinion that it was an inverted uterus. It was impossible to pass the hand above the tumor, on account of its size. The loop of a wire rope, attached to Braxton Hicks's écraseur, was passed above it, and as the screw was turned until the loop began to compress the part included, violent suffering, amounting almost to shock, occurred, so that the solitary opinion as to the nature of the tumor for a moment embarrassed the operator, and made him doubt his diagnosis. But the tumor was a fibrous polypus, and the severe pain came from the dragging of the pedicle, nearly an inch in thickness, closely attached to the uterine wall.

After this statement it is apparent that too much importance must not be attached to the presence or absence of sensibility in determining the differential diagnosis; yet Denuce compares the pain caused by pressing an inverted uterus to that which follows pressing the testicle in a hydrocele. Again, the special contractility of the uterus which may be excited by manipulation, is a sign pointed out first by Valentin, and nine years later by Steinhausen, but it certainly may and does fail in some cases, for the inverted organ may be motionless and passive as any polyp, a fact which need not surprise us when we remember how important as chief or as assistant factor in the production of the displacement inertia of the organ is, an inertia which is not likely to disappear under the shock resulting from hemorrhage and pain. Let no one failing to find sensibility and contractility in a doubtful tumor, thence conclude that it is not an inverted uterus.

Prognosis.—The statistics of Crosse show that of 109 cases untreated, there were 72 deaths within a few hours, 8 after a week, 6 in the first two months, 4 between the eighth and ninth month, while 18 patients lived from one to twenty years. The causes of death have been hemorrhage, shock, inflammation involving the abdominal cavity, or gangrene of the uterus. Crampton's statistics[1] show that of 120 recent cases, 87 recovered, 7 died, and 1 remained unrelieved. The author states that death occurs in 20 per cent. of recent inversions, whatever the treatment.

Crampton found that in 92 cases of recent inversion, reduction was effected in from five minutes to eight and a half hours, either with the fingers or knuckles, or whole hand, or rectal bougie; in one case by means of a stick eight inches long and one inch in diameter well wrapped in rags.

Treatment.—The sooner after the accident an effort at reduction be made the more likely is it to succeed, and therefore let no time be lost; moreover, prompt reduction relieves the patient from more or less severe suffering and from imminent peril.

If the placenta is attached, it should be first removed. For the

[1] American Journal of Obstetrics, 1885.

reduction we have three methods of exercising taxis, which are known as central, peripheral, and lateral. The rule is that the taxis in recent inversions shall be by the hand, and not by instruments. In case, therefore, central taxis is selected under these circumstances, the practitioner forms a cone by the fingers of one hand, and with this presses against the fundus of the uterus; or, instead of using the fingers he may use the fist, as was first done by Levret, and afterward by Lazzati in imitation. It is evident that by this indentation or depression of the inverted fundus that part is restored first which escaped first; and it is likewise evident that in this manipulation there must pass through the constricted portion, the neck of this hernia, four thicknesses of the uterine walls, and for such passage great dilatation, or great relaxation is necessary.

In peripheral taxis the uterus is embraced by the hand, the fundus resting in the palm, and the fingers and thumb extend upon the walls of the organ, reaching to the collar formed by the cervix at the vagina, and they are used to stretch that, and thus invite the return first of that portion of the hernia which escaped last; it is evident, too, not only that the principle just mentioned governs the method of reduction, but also that only two thicknesses of the wall pass through the constricted portion at a time.

Lateral[1] taxis is that in which the uterine globe being embraced by the hand, the four fingers are applied upon the right postero-lateral wall which they maintain fixed by sufficient pressure, while the thumb rests upon the inferior part of the left antero-lateral wall depressing it; the thumb sinks deeper into the depression thus made, and causes this inverted portion to pass farther and farther in until finally the entire organ is restored. This method, however, is not usually applied in recent inversions though it has succeeded in some cases. But in all methods of taxis counter-pressure must be made with the free hand just above the pubes, and hence the patient is most conveniently placed, if there be time, in the forceps position usually employed in this country. Spiegelberg justly insists that efforts at restoration ought to be made not only according to the axis of the uterus, but also according to the axis of the pelvis in order to avoid the projection of the sacral promontory.

But in case the patient is not seen until several hours after the accident, immediate reduction should not be attempted, unless the uterus is found soft and relaxed; Siredey and Danlos advise, that when it is found contracted and in a tetanic condition, waiting until the spasm and irritation have disappeared. Nor is it advisable to attempt replacement if the organ has become inflamed. Further, where efforts at restoration have been made immediately after the accident, and repeated in the next two or three days, unsuccessfully, it is better not to renew them until the puerperal period has passed, for immediate danger to the patient is not now to be apprehended from the mal-position of the uterus, persistence in manipulations may cause serious inflammation, and the success in the reduction of chronic inversion is so constant that the delay proposed is advisable.

[1] Denuce, op. cit.

PART IV.

THE PUERPERAL STATE.

CHAPTER I.

THE PHYSIOLOGY AND THE MANAGEMENT OF THE PUERPERAL STATE, AND ITS DIAGNOSIS—CARE OF THE NEW-BORN CHILD.

PUERPERALITY, or the puerperal state, follows labor, and continues until the genital organs return to their condition prior to pregnancy, and hence includes a period of about six weeks. But here a qualification of fact and one of time should be stated. There is never an entire restoration of the genital organs, especially in the primipara, to their ante-pregnant condition, the changes caused by gestation and labor are not completely effaced; and, as will be seen in the study of uterine involution, some of the phenomena in this process last much longer than the period mentioned.

While pregnancy was marked by extraordinary hypertrophy, a reverse process especially characterizes puerperality; construction marks one, demolition the other. There was a building up, and now there is a tearing down, and removal of structure no longer needed. Moreover, in the early part of the puerperal state, a new function is called in exercise, that of the mammary glands; these organs, designed to supply nourishment for the infant during the first eight or ten months of extra-uterine life, enter into action while the ovaries and the uterus rest; ovulation, gestation, and lactation are the three characteristic functions of the female organism, and they are exercised in succession.

It is important to know the physiological phenomena of childbed, so that deviations from them may be at once recognized, and, where possible, promptly arrested. The liability to such deviations is in some cases very great, and they are in all among the possibilities. The condition of a woman after delivery has been compared to that of a person who has undergone a grave surgical operation; neither is laboring under disease, but each is more or less exhausted, and each has undergone a traumatism which opens the doors for the entrance of disease-germs, and both need intelligent and constant care to guard against danger, and to guide to perfect recovery.

The woman who has just passed through childbirth usually enters into a period of calm rest. The stormy struggle, the severe physical suffering, and the anxiety are happily ended for most in quiet and

peaceful joy. Generally the puerpera is disturbed by conversation, or by movement of her body; her replies to questions are usually in a low tone of voice and brief, and she desires above all things mental and physical rest. In some cases there is very great nervous prostration, presenting as far as frequency of pulse and somewhat difficult respiration are concerned, the characteristics of post-partum hemorrhage, and the heart's action is very feeble, but an error of diagnosis is easily avoided by finding the uterus well contracted and the flow quite normal. Perfect rest, the administration of a stimulant, or a hypodermatic of sulphuric ether with digitalis may be required. But these are quite exceptional cases, and much more frequently a chill occurs. In about one-third of parturients there is a chill during labor or soon after; the latter is the more frequent. This chill, which is oftener observed after a rapid labor, lasts from a few minutes to a quarter of an hour; it is not attended with any change in the pulse or in the temperature. The most probable explanation of this phenomenon is that the organism suddenly loses a mass to which it had been progressively accustomed, and this rapid depletion of the abdomen causes immediate cessation of compression of the viscera, the blood leaves the exterior to fill the space left in these organs. But whatever the explanation the chill is physiological, and portends no danger.

After-pains.—A still more frequent cause disturbing the rest of the newly-delivered woman, if she be a multipara, is the occurrence of painful contractions of the uterus. These are more severe after a rapid labor; indeed they may be absent if it has been slow, they only exceptionally occur in primiparæ, and they are more frequent, too, if the uterus has been greatly distended. They generally begin a short time after the expulsion of the placenta, recur at intervals of five, ten, fifteen, or twenty minutes, and disappear after twenty-four hours; they are excited or increased by the application of the child to the breast; exceptionally they continue for two days, or even somewhat longer. When after-pains are very close together, and continue thus for some hours, the fact is cause for anxiety, as they may indicate the beginning of a metro-peritonitis, and the temperature of the patient should be carefully watched. Depaul refers to them as becoming inflammatory, and then they may last for eight or ten days—that is to say, during the entire duration of the acute period of metritis.

Expulsion of clots is usually caused by these painful contractions of the uterus, and when they are moderate in severity their occurrence is favorable, for they show a uterine activity which is a safeguard against hemorrhage. The diagnosis ought not to present any difficulty, for the hand placed upon the abdomen recognizes the contraction of the uterus.

Prochownick has shown[1] that in some cases of diastasis of the abdominal muscles the intestine may protrude through the opening, and pain result which may be mistaken for after-pains, and probably is thus mistaken in many cases. A careful examination will recognize the cause of suffering.

The Pulse.—During labor the pulse usually increases from 70 or 75 to 90 or 100; but a short time after delivery its frequency lessens, and

[1] Op. cit.

sinking below the normal in from eight to forty-eight hours; usually the pulse oscillates between 50 and 60, but, according to Blot, between 44 and 56; Olshausen makes it between 40 and 50, and in rare cases says it falls below 40; the lowest that I have observed was 46. Marey has attributed the slowing of the pulse to increase of arterial tension, a fact which is not admitted by all, some asserting indeed that the arterial tension is lessened. Other explanations of this phenomenon are the perfect rest of the patient, the increase of fat and of leucocytes and diminished red globules in the blood, lessened respiratory movements and the restricted diet. It must be confessed that no satisfactory explanation has as yet been given. The slowing of the pulse is justly regarded as a favorable indication, and the slower the more favorable.

The duration of this slowing is usually several days, and the period when it is greatest is from the fifth to the seventh day (Olshausen), but the recent investigations of Louage[1] have led him to conclude that it is the morning of the seventh day. Buffet, as quoted by Kleinwächter, says the slow pulse lasts in multiparæ from five to seven days, but in primiparæ only from three to four.

The Temperature.—During labor there is generally some increase in the temperature, and this increase may be observed for twelve hours or more after; it is a little greater in primiparæ, and may amount to two or three degrees. But within twenty-four hours the temperature declines and remains stationary during seven or eight days, there being only the usual morning and evening variations. The following table gives the result of the average temperatures of twelve patients in whom puerperal convalescence occurred without distubance; the first temperature was taken twenty-four hours after delivery.[2]

	Morning.	Evening.
First day	98.4	98.8
Second day	98.4	98.8
Third day	98.2	98.8
Fourth day	98.2	98.4
Fifth day	98.2	98.9
Sixth day	98.4	98.8
Seventh day	98.	98.4
Eighth day	98.2	98.4

The highest temperature observed in any one of these twelve women was $98\frac{4}{5}°$, and this occurred on the fifth day. Transient elevation of temperature may arise from mental causes, from disorders of digestion, or from getting up too soon. But as Tarnier remarks these momentary elevations do not generally involve an unfavorable prognosis; it is not the same with those that are progressive and continued; especially when the thermometer placed in the axilla ascends above 100.4, some complication ought to be feared.

Respiration.—The pulmonary capacity according to Dohrn's investi-

[1] Le Pouls Puerpérale Physiologique, par Pierre Louage. Paris, 1886.

[2] I am indebted to Drs. Phillips and Randall, resident physicians in the Obstetric Department of the Philadelphia Hospital during one of my terms of service for the preparation of this table.

gation increases in the majority of cases; the respirations are from 14 to 18 per minute.

Modifications of Secretions.—A few hours after delivery the body is generally covered with perspiration; this secretion is more marked during sleep, and continues for about a week. Naegele draws attention to the fact that on the head the congestion of the skin results in exudation into the hair-follicles which very generally involves the loss of part of the hair. The quantity of urine secreted during the first twenty-four hours of childbed is increased, while its specific gravity is lessened during one or two days. The presence of sugar in the urine of women in the course of their lying-in and while nursing was first shown by Blot in 1856. This condition probably should be termed lactosuria rather than glycosuria, for the view most generally held as to its origin is that it results from the passage of unused lactose into the renal secretion in consequence of there being an excess of milk formed or of arrest of nursing, in other words, as stated by Spiegelberg, it is a resorption diabetes.

Macdonald found sugar present in each of thirty-five lying-in women, and therefore regards it as present in all cases at some time in the puerperium. Neither Kleinwächter nor Spiegelberg refer to it as being invariably present. In examinations made daily of the urine of fifty women at the Philadelphia Hospital, beginning a few days before, and continued seven days after delivery, sugar was found in the discharges of four women before the labor, and of six after labor, one of the six also being one of the four. In this woman the sugar was constantly and abundantly present up to eight weeks after delivery; she had remarkably well developed mammary glands, and a very abundant secretion of milk. In her case the test for a good wet-nurse suggested by Blot, to wit, the quantity of sugar found in the urine, would have proved true, as far as the abundance of milk was concerned.

Retention of Urine.—Inability to evacuate the bladder is not uncommon, especially in primiparæ, if the labor has been protracted. The causes of the urinary retention are the ample space given the bladder to resume its spherical form while during the latter part of pregnancy it was flattened, the swelling of the urethra and the neck of the bladder from severe compression in labor, the loss of abdominal pressure, and the position which the patient occupies while attempting to urinate, that is, she is horizontal. If the bladder be distended with urine, the uterus is carried higher up in the abdominal cavity. Such distension, too, may cause secondary hemorrhage.

Condition of the Digestive Organs.—The appetite for the first two or three days is lessened, but in consequence of the activity of various secretions, especially of the kidneys and the sudoriparous glands, the thirst is great. Evacuation from the bowels is delayed, partly because of having been so thoroughly emptied in labor, and partly because of the character of the food usually taken, and because of the woman being in such absolute rest.

Psychical Condition.—The newly delivered woman is peculiarly nervous and sensitive, and disturbed by causes to which she would be ordinarily indifferent.

Hubert states that at Harlem, the house of the lying-in-women could not be entered by creditors or officers of justice.

In ancient Rome garlands were suspended above the door: *Foribus suspende coronas: jam pater es.* (*Juvenal, 9th Satire.*)

Lochia.[1]—This name is given to the flow from the genital organs in childbed. It contributes to uterine involution, and indicates that process. This flow is composed of red-blood corpuscles, shreds of uterine decidua, sometimes of fragments of the placenta or of the membranes, epithelial cells from the uterus and vagina, leucocytes, also pus cells, granule-clusters, granules, pigment, free fat, mucus, clusters of zooglea, infusoria (trichomonas vaginalis), etc., the quantity of each varying with the period of the flow.[2] The discharge is alkaline for the first eight or nine days, when it becomes neutral or acid. The flow is at first chiefly sanguineous, then sero-sanguineous, serous, and finally purulent. The first two varieties are included under the term *lochia rubra*, which is bright red at first, then at the close pale from the diminished number of red globules and the increase of leucocytes; it changes about the fifth or sixth day into the *lochia serosa;* about the seventh day the lochia has a cream-like consistence, and is yellowish in color. It receives the name of *lochia alba*, when the discharge is composed of pus-cells, epithelial cells in various stages of development, spindle-shaped connective tissue cells, fat granules, free fat, and cholesterine crystals. The discharge becomes gradually less, loses its opacity, appearing like the uncooked white of an egg, and disappears in two to four weeks.

According to Gassner, the quantity of red lochia, until the fourth day, is one kilogram, 2.2 pounds, of the serous lochia until the sixth day, 280 grams, between 14 and 15 ounces, and of the white lochia until the ninth day, 205 grams, nearly 7 ounces, so that the entire loss of weight from the lochial discharge is about three pounds and a quarter.

It is not unusual for the lochia to be very much lessened, or for a few hours absent, during the establishment of the secretion of milk. The red flow is liable to return after having disappeared, or to persist beyond the usual time in women who get up too soon, and resume household duties; in some cases it preserves this character until all discharge ceases. Exceptionally, the flow stops much earlier than the usual time, but an early cessation is not to be regarded as pathological, unless other symptoms indicating such condition occur. Doléris has stated that in a patient living in the country, having a well-ventilated room, and being in other favorable circumstances, the lochial discharge may be much less in quantity, and much shorter in duration than in a woman in the city, and in a crowded maternity. Most authorities state that those women who nurse their infants have a less flow than those who do not; this seems to be a reasonable statement, though some deny it.

[1] Λοχια, or Λοχεια was one of the names given to Artemis or Diana, from her helping presence at childbirth. From the adjective Λοχιος, *belonging to childbirth*, we have the words used by Hippocrates, Τα λόχια, and λοχία, ἡ, the discharge after delivery. It would seem, therefore, that lochia may be used in the singular or in the plural.

[2] Kleinwächter.

Tarnier suggests that in general practice the quantity of the lochial discharge may be approximately estimated by the number of napkins required in twenty-four hours; thus, during the first day twelve will be used, the second eight, and the third six; while after this, only four or five.

The odor of the discharge is sometimes described, if this be indeed a description, *sui generis*, or as the *gravis odor puerperii*. But, as stated by Siredey, the intensity and character of the odor are in relation with the odor of the perspiration and other secretions of the individual; but, whatever the individual varieties, it ought never to be fetid, suggesting that of macerating anatomical specimens, or of putrefying organic matter.

Changes in the Genital Organs—Involution of the Uterus.—A woman immediately after labor has more or less soreness of the external organs of generation. They are tender, and there is the feeling as if they had been bruised, as indeed they have; if a primipara, there is more or less tearing of the vulvar orifice, such injury affecting the fourchette, sometimes the nymphæ, less frequently the labia majora, and in some cases the anterior margin of the vulva. These various parts may become œdematous, but the swelling usually disappears in two or three days, and they gradually return in the main to their condition before pregnancy, at least the hypertrophy of the organs disappears. The vagina gradually becomes shorter and narrower, but its columns and rugæ never are as distinct as before labor; its muscular tissue probably in part undergoes fatty degeneration, and consequent atrophy, while the superficial epithelium of its mucous covering is exfoliated; during the continuance of the lochial discharge there is a catarrhal vaginitis. The layers of the broad ligaments, separated by the growing uterus, re-unite, and the ovaries and oviducts take their usual position in the true pelvis.

But the most remarkable changes occur in the uterus, by which this organ which, according to Spiegelberg, weighs at the end of labor one kilogram, is reduced in a few weeks to nearly the weight it had in the unimpregnated condition. The process by which this change is effected is called involution. The uterus was progressively evolved in the course of pregnancy to meet the requirements of the new being, and now that gestation has ended, there being no further use for such size and capacity, the organ is involved.

As Kleinwächter remarks, uterine involution begins with the first labor-pains. He further states that the contraction of so large a muscle must go hand in hand with a change of matter increasing to a high degree, and although the production of heat is by the consumption of non-nitrogenous substances, yet long-continued and increased action leads to the destruction of the functionally active contents of muscle-cells. Beside, the formation of new protoplasm is interfered with by the compression of bloodvessels during uterine contractions, and the involution of the muscle is thus in part effected.

In regard to the degree and the character of the changes that occur in the ultimate muscular tissue, authorities are not agreed. According to Spiegelberg the uterine muscular substance, pale at delivery, be-

comes yellowish from the sixth day, the color being due to a granulo-fatty degeneration of its fibres. But Robin has stated that the presence of minute drops of fat can be seen from the third month of pregnancy; he adds that the diminution of volume of the muscle-fibres is made solely by atrophy which occurs after labor, and he insists that the fatty infiltration lessens as the muscular fibres atrophy. Heschl's view, adopted by most obstetric authorities, attributes very great importance in uterine involution to fatty degeneration. This degeneration begins about the fourth or sixth day in the form of minute fat drops, which by degrees extend so as to fill the fibre-cells, and soon effect their destruction. From the fourth week a new formation is evident in the external muscular layers, appearing first as nucleated cells which soon become fibre-cells; destruction and regeneration march side by side, and towards the eighth week, the latter is complete. The most recent investigations[1] have been made by Mayor; from the careful examination of the results obtained by Leopold, Spiegelberg, and Heschl, he thought that some of the anatomical specimens which these authorities examined were the seat of puerperal lesions, and consequently the micrographic results had not all the accuracy desirable. His own investigations led him to conclude that fatty degeneration of the muscular fibres was more marked than Robin thought, but still had not the importance attributed to it by Heschl. From the fact that it was at its maximum at the points where these elements most rapidly resume their primitive volume, he regarded the degeneration as only a momentary transformation of the protoplasm of the cells designed to favor absorption, and the disappearance of the materials which constitute the gravidic hypertrophy.

The doctrine that there is a complete regeneration of the uterus certainly seems improbable. Admitting the truth of Aristotle's statement that nature does nothing in vain, it seems utterly unnecessary to destroy the whole, in order to remove a part. Moreover, it is somewhat remarkable, that if there is such entire regeneration, a new uterus in fact created, the organ in another pregnancy, and after another labor, behaves so differently from the primitive one; the new uterus is more readily distended, and preserves its typical form less completely; after labor, it fails to contract perfectly, and thus permits the accumulation of blood-clots, and consequent after-pains. Nature may go on constructing a new uterus a dozen times even, and, in some cases, the oftener she tries, the more the product of her work deviates from the original pattern.

Kleinwächter states that we do not accurately know how this transformation in the muscular tissue takes place, nor whether the entire muscular cell disappears, and in what manner the new one is formed.

The greatest reduction of the uterus in weight takes place in the first eight days, for at the end of this time the organ weighs only one-half what it did just after labor.

The restoration of the mucous membrane proceeds at the same time as the involution of the uterus. Normally, the superficial layer of the mucous membrane, the *decidua vera* of Hunter, is detached and ex-

[1] Siredey, op. cit.

pelled with the placenta and membranes; but no small part of it may be retained, passing off by fatty degeneration with the lochia. The uterine glands retain their lining; these are brought closer together by the retraction of the uterus; from the glandular cul-de-sacs epithelium is formed, which extends toward the uterine cavity, these proliferations about the end of the third week, according to Leopold, reaching the surface, and at the end of the fifth week this investment is complete, that is to say, a new mucous membrane formed from that lining the glands, covers the uterine wall. Very important changes occur at the site of the placenta. In the eighth month some of the venous sinuses are closed by thrombi, and after the expulsion of the placenta, the remaining ones are closed in the same way; the thrombi degenerate and are gradually absorbed, but the process is not completed before the fourth or fifth month.

Changes in the Bloodvessels.—It is generally taught that many of these vessels are so firmly compressed by the contraction of the uterus, they undergo fatty degeneration and absorption. The larger arteries are partially obliterated by proliferation of the connective tissue of the *intima;* the *media* is destroyed by fatty degeneration; new muscular elements take the place of the degenerated ones where the vessels are to remain; other vessels are simply narrowed, and continue. According to Balin, the regressive metamorphosis begins later, and lasts longer than the same process in the muscular structure of the uterus, occupying several months.

Position and Form of the Uterus.—Immediately after delivery the uterus is a round, hard body reaching a little more than four inches, eleven centimetres above the pubic symphysis, and very nearly the same distance from side to side. A few hours later, either from relaxation or from the bladder being filled, it reaches somewhat higher; subsequently a more or less continuous diminution goes on so that by the tenth day the fundus is at the superior margin of the pubic joint; the daily decrease in the height of the fundus above the pubic symphysis being from two-fifths to four-fifths of an inch, or from one to two centimetres. During this time its position varies with the position of the patient, but it inclines toward one or the other side, and does not occupy the median line. The puerperal uterus is often anteflexed, and in some cases this anteflexion is so great that an obstruction to the passage of the lochia is caused, and the condition known as lochiometra results. The diminution is more rapid in multiparæ and in those who nurse; so too Charpentier is positive that involution is more rapid in women to whom ergot is given.

Depaul gave the following as the approximate relative positions of the fundus of the uterus in the first days of the puerperal state. The first day it is a finger's breadth above the umbilicus; the second day at the level of the umbilicus; the third day a little below; the fourth day but little variation from the preceding; the fifth and the sixth days two fingers' breadth below; the seventh, eighth, and ninth days three or four fingers' breadth above the pubic joint; the tenth, eleventh, and twelfth days at the level of or a little below the pubis.

The progress of uterine involution has been sought to be ascertained by

some through measuring from the symphysis to the fundus, by others by means of an instrument similar to the pelvimeter, one branch of which is placed upon the abdominal wall at the fundus and the other in the vagina at the mouth of the uterus, Autefage, and by others by means of the uterine sound, Sinclair, Charpentier, and Milsom.

Changes in the Neck of the Uterus.—Directly after birth the neck of the womb is relaxed and soft, and has been compared by Kleinwächter to the uvula; the canal admits three or four fingers readily, but slight resistance is offered by the internal os; the length of the cervix is about 2.7 inches, or 7 centimetres. At the tenth day the canal no longer admits even one finger, and by the twelfth the neck is only 3 centimetres, or a little more than an inch long, according to Lott.

Loss of Weight in Labor and during Lying-in.—Gassner states that the body increases during the last three months of pregnancy about one-thirteenth of the entire weight; this increase is proportionally less in primiparæ than in multiparæ; during labor a woman loses one-ninth of that she had at the end of pregnancy, this loss being chiefly due to the expulsion of the fœtus and its appendages, and the amniotic liquor, but also to the blood lost in the discharge of the placenta, to fecal matter expelled, and to pulmonary and cutaneous excretions. During the first eight days of lying-in the woman loses one-eleventh, the loss resulting from the lochial discharge, the increased action of the kidneys and the skin, and the mammary secretion. The total loss of weight in labor and in the puerperal state amounts to about one-fifth that of the body. At the end of three or four weeks after labor the loss has ceased, and generally a gain begins.

The Secretion of Milk.—During the latter part of pregnancy and immediately after labor a fluid called colostrum is found in the breasts, and often spontaneously exudes or can be pressed from the nipple; to this fluid, as found in the cow immediately after calving, the name of *biestings* is given. An abundant secretion of colostrum in pregnancy indicates a large supply of milk. Colostrum differs in color, specific gravity, composition, and morphologically from milk. It is yellowish-white, is richer in fat and sugar than milk, and contains albumen instead of casein; it has a larger supply of salts than milk, and hence, according to most authorities, proves a laxative to the newborn child, assisting in carrying off the meconium; but this excess in salts is not great, and it is more rational to attribute the laxative property of the fluid, as De Sinéty does, to its richness in glandular elements, which produce indigestion. The following is Marchand's statement as to the composition of the two fluids:—

In 100 parts of each—

	Colostrum.	Milk.
Proteine elements	17.20	1.90
Lactine	6.30	5.30
Butter	4.50	4.50
Salts	.25	.18
Water	71.63	81.12

The liquid portion of milk is simply a transudation from the blood, while the morphological constituents proceed from the glandular cells.

Colostrum corpuscles are remarkable for their size, contain fat granulations, and are probably detached glandular elements; either the cell-wall is broken down, and the contents set free, or, as De Sinéty holds, the cells have contractile movements, and by these the fatty particles are expelled. These minute fat granules unite together to form larger masses and of different sizes; their mixture with the transudation from the blood forms a fine emulsion, and this is milk. The casein of milk is probably formed from the albumen of the blood, and the sugar of milk from the glucose.[1]

Phenomena associated with the Establishment of the Secretion of Milk.—The current of blood which has been flowing to the uterus for nine months now turns to the mammary glands, and on the second, or oftener on the third day these organs enlarge and their sensibility increases; the skin covering them is smooth and tense, the nipples are less prominent, and very frequently some pain is felt in the axillary glands; in consequence of the swollen condition of the breasts the arms cannot be brought close to the sides of the chest. The general phenomena attending upon the beginning of the milk flow are restlessness, thirst, headache, occasional neuralgic pains, loss of appetite, and possibly some increase in temperature and the frequency of the pulse. But that which the old authors called milk fever is not now admitted; in very rare exceptions decided fever, even preceded by a chill, and lasting twenty-four hours has been observed in cases where no complication was present, but the almost universal rule is that there is no milk fever; as Lorain remarked it is a vague tradition which does not rest upon classic observation. Siredey collecting in one year 360 observations with reference to its existence or not, states as the result that he can affirm that in every case where the tempera-

[1] *Rauber's views on the mamma and the lacteal secretion* are somewhat startling, but must occupy our attention here. From a series of very carefully conducted examinations, principally on the glands of guinea-pigs during and after pregnancy, he feels justified in concluding that milk owes its origin to the entrance of countless leucocytes into the lumen of the gland vesicles. The emigrated lymphoid elements, he believes, penetrate the alveolar walls, passing through the single layer of epithelial cells which lines them. Arrived in the interior of an ultimate acinus, the leucocytes undergo fatty metamorphosis, and thus furnish the most essential and characteristic ingredient of milk, viz., the milk-globules. Rauber, therefore, discards the notion that the formed particles of the lacteal secretion originate in the glandular epithelium, and represent the elaborated products of its functional activity. He also denies that previously formed milk-globules or colostrum corpuscles ever pass through the alveolar walls. Thus the primitive opinion advanced by Empedocles, describing milk as white pus, is in a measure revived, and milk is held to be directly derived from the white corpuscles of the blood.

Preparations of mammary glands taken from animals still suckling their young, according to him, invariably show the intra-glandular lymph-vessels replete with leucocytes, the stroma similarly infiltrated, identical corpuscles in greater or less abundance within the vesicles, and transitional form between lymphoid-corpuscles and milk-globules. These claims, granted to be facts, and considered in conjunction with the circumstances that epithelial proliferation is not seen, would certainly go far to make Rauber's theory seem a somewhat plausible one. Nevertheless, we require corroborative evidence from others before his views can be accepted as anything more than an ingenious hypothesis.

Rauber has also described the occurrence of a delicate striation within the epithelial cells of the alveoli. These striæ are said to be in all respects similar to those found in the secreting elements of certain portions of the salivary glands and the tubules of the kidneys." Manual of Histology, edited and prepared by Thomas E. Satterthwaite, M.D., 1881.

ture in the axilla exceeded 100.4°, he always found the explanation of the febrile movement independent of the lacteal secretion.

Chantreuil's investigation led him to conclude that the morbid entity, called milk fever, very rarely occurred; that in entirely normal cases the pulse did not rise above 76, and consequently there could be no question about fever, and that the temperature followed the variations of the pulse. In normal cases the the temperature did not rise during the secretion of milk above 100.4°, or 100.2°, figures which have been adopted as expressing the mean temperature by all authors who have been occupied with the study of thermometry.

The secretion of milk continues from 8 to 12 months. The quantity increases until 6 or 7 months, and decreases from the 8th month. The casein increases until the 2d month, and decreases from that to the 9th, and so also the butter; the sugar lessens the first month, then increases; the salts increase the first five months, and then diminish.[1] If the woman does not nurse, the milk disappears in about a week. The quantity secreted is said to amount to about one kilogram. Menstruation is, as a rule, absent during lactation, but ovulation may occur, and it is not uncommon for women to conceive while nursing; should conception occur, the supply of milk lessens, and finally ceases.

The Management of Childbed.—There will be considered under this head not merely the case of the mother, but also that of the child.

Attentions to the Mother.[2]—After the thorough cleansing of the external sexual organ by a warm antiseptic solution and a similar injection in the vagina, the necessary care of injuries mentioned on p. 423, and proper arranging of the bed and body clothing, the patient may have some nourishment if she desires, and should have if she needs it.

Rest.—In the great majority of cases, a few hours' sleep will be the most important restorative, and, therefore, means that conduce to this end should be used. Generally a quiet room and moderately darkened will be all that is required; but in some cases there are such restlessness and nervous excitement that an opiate must be given. So, too, if after-pains are so severe and frequent that she cannot sleep, and external applications, *e. g.*, of cloths wrung out of hot whiskey, with compression of the uterus, fail to relieve, opium and camphor may be given; quinine in a dose of ten grains is used by some practitioners.

The practice which old obstetricians had of preventing a woman's sleeping during the first hours following labor lest flooding might occur, had no just foundation either in reason or in experience.

Of course the room is free from visitors, and if the baby's cries disturb the mother it should be taken for a few hours into another room.

[1] Zuelzer, quoted by Kleinwächter.

[2] In some parts of the world it appears that attentions to the father are of great importance, thus:—

Peschel, *The Races of Men*, pp. 24–5, refers to paternal lying-in as having been observed by inhabitants of the four quarters of the globe—in Borneo, for example, the father of the new-born child is for eight days allowed to eat nothing but rice, must take care not to expose himself to the sun, and must give up bathing during four days; and states such coincidence of error can be explained in one or the other of only two ways—either all the varieties of our race once dwelt together in a narrow home when the error originated, or the mental faculties of all these families even in their strongest aberrations are the same.

She should lie the first few hours chiefly upon her back, and then occasionally upon either side, for it is better she should not be restricted to one position.

The question as to absolute rest in bed for some days after labor is not a new one. Sydenham's wise observation taught him that of those who died after childbirth, the result in the great majority of cases was from getting up too soon, and he said he did "not suffer a woman to get up before the tenth day." That sagacious and successful obstetric practitioner, the late Dr. Churchill, stated that for one evil result from an error in diet, he had some ten from assuming an upright position, or leaving the bed too soon. White,[1] on the other hand, had the puerpera sit up in bed a few hours after delivery, and the sooner she got out of bed the better; this was not to be deferred beyond the second or third day. Goodell has the patient sit up the day after labor, while her bed is making; this sitting up is repeated once or twice a day, until the fourth or fifth day, when she, if so disposed, gets up and dresses herself. Solovieff[2] confirms the practice of Goodell.

Garrigues,[3] in an excellent article upon the subject, remarks, "Combining the teachings of great obstetricians and the consideration of the anatomical and physiological conditions with my practical experience, I have come to the result that the patient ought to be left lying quietly in bed, alternately on her back and on her sides, until the uterus has contracted sufficiently to be hidden behind the symphysis, and until all raw surfaces in the obstetric canal are covered with granulations, or healed, and that during two months she ought to avoid any great exertion."

Avrard states that in order to escape all pathological influences that threaten her, the puerpera should keep her bed for twenty-five or thirty days, and that she should not resume any fatiguing occupation or conjugal life until three months after labor; Charpentier would have her remain in bed three weeks, often more, never less: Kleinwächter permits her to leave the bed after ten or twelve days, but several more days must pass before she can be up all day; Kormann says that the patient should remain quiet for nine to twelve days after labor at term, as well as when premature.

These various opinions and rules of practice that have been stated, indicate that even practical obstetricians differ greatly in regard to this matter. While some nurses and doctors think it is to their credit that the sooner a women after confinement is up and dressed, apparently well, the greater their credit, it must be admitted that very serious injurious consequences of too early getting up may not be immediate but remote, such as uterine displacement or subinvolution, and that prolonged rest is a less evil than the former; better keep a woman in bed a week too long, than have her get up a day too soon. Again, every woman is a law unto herself; one may convalesce much more rapidly than another, and uterine involution occur more rapidly. The condition of the patient is a better criterion as to the propriety of getting up, than the number of days since labor; so, too, the effect produced by being up ought to be considered in deciding as to the propriety of permitting it to be continued, so that if, for example, the woman has a return of

[1] Treatise on the Management of Pregnant and Lying-in Women.
[2] Archives de Tocologie, Feb. 1881.
[3] American Journal of Obstetrics, 1880.

the red lochia, or if abdominal pain be caused, the indication is very plain for immediate return to bed. It is probably best for most women not to sit up until ten or twelve days have passed, and then only for a short time; and it would be better for the puerpera to remain in her room for at least three weeks.

Food.—In regard to this question the most diverse opinions have been held. Dionis refers to the popular notion of his day that a woman has lost so much blood in labor, and so much too is lost by the lochia, she ought to eat more abundantly than at any other time, in order to repair the loss, and condemned it, because the woman was in "a state of fever," and the fever was sure to come on the second or third day. Dewees would not allow any animal broth until after the fifth day, or any animal substance until after the fifteenth; he gave for the first few days oatmeal gruel, tapioca, sago, mush and milk, rice and milk, tea, coffee, or very thin chocolate. In recent years, however, there has been a reaction against the absolute diet once insisted upon by obstetricians, and some have found in this change of practice the explanation of a lessened puerperal mortality, and of fewer cases of so-called milk-fever. But there is a just mean between famishing and feasting, between absolute and generous diet which the practitioner will best follow. Those who have seen how well a patient, upon whom ovariotomy has been performed, gets on for the first few days with water, barley-water, and lime-water and milk, will hardly believe that the puerpera in the first days needs either chops for breakfast, and abundance of roast beef for dinner, but rather that she will convalesce more rapidly if liquid food is chiefly given. Indeed, her often temporarily enfeebled digestion and her little desire for solid food point very plainly to proper dietetic practice; her thirst is usually much greater than her hunger. At this time the simpler articles of food, such as tea and toast, the lighter animal broths, milk toast, or soft boiled eggs will be most acceptable; let her gradually resume her usual diet. On the other hand, there are women whose digestion is perfect, and whose appetite from the first craves more liberal nourishment, and there can be no objection to giving them, from the beginning, the more easily digested animal foods. Or again, there may be a patient so greatly exhausted that beef-tea, milk-punch, or eggnog must be given at frequent intervals. Therefore, no absolute rule as to the diet of the first days can be given; each case must be judged by itself, and the food directed according to the condition. Cold water will be usually found the most acceptable drink, and can be given at frequent intervals. If, however, the secretion of milk be too abundant, it will be diminished by lessening the quantity of fluids taken, and under these circumstances, it is well to have the patient quench her thirst by pieces of ice rather than by copious draughts of water, or of other fluid.

The Condition of the Bladder.—The puerpera should be directed to empty the bladder twelve hours after delivery, for unless so advised she may be unconscious of the accumulation of urine, and it may continue until the organ is so greatly distended that spontaneous evacuation is impossible, even in case there be no obstruction of the urethra

from swelling. If urine is not passed within eighteen hours, the catheter must be used, and its use repeated twice in twenty-four hours until the patient recovers the lost power; the instrument should be carefully disinfected before and after use, for a catarrhal cystitis may result from neglect of this precaution. In some instances there is dribbling of urine from a very full bladder, and both the patient and nurse insist that the organ is completely emptied when in fact it contains a large amount of urine; in all doubtful cases the practitioner should carefully palpate the abdomen, and if doubt remains remove it by introducing the catheter. The patient usually recovers the power of urinating at the time the bowels are first moved.

Condition of the Bowels.—On the third or fourth day a free alvine evacuation is to be had either by a warm-water enema, by a dose of calcined magnesia, by Rochelle salts, a Seidlitz powder, liquid citrate of magnesia, one of the mineral waters, as Hunyadi-János, or by castor oil, which remains notwithstanding all prejudices and reproaches one of the safest and most certain laxatives for the puerperal woman. In case she does not nurse her infant a saline is preferred, as the watery operation to some extent lessens the determination of blood to the mammary glands. After the first free evacuation the bowels should be moved every day, or every other day.

The Lochia—Care of the External Genitals—Vaginal Injections, etc.—Napkins are usually applied to receive the lochial flow; it would be well to have them sprinkled with a warm antiseptic solution before application, or to replace them by absorbent cotton, also made aseptic, which after use may be burned; frequent changes of napkins or cotton must be made for the sake of cleanliness. At least once a day the external genital organs are to be bathed with a warm antiseptic solution, *e. g.*, corrosive sublimate, 1 part to 3000 of water, and if there be the least offensive odor of the lochia a similar solution should be injected in the vagina twice or oftener in the twenty-four hours; but unless there be this indication antiseptic vaginal injections are not indicated. Raw surfaces at the vaginal entrance or upon the external genitals are to be carefully and gently washed twice a day, and then a ten per cent. carbolized oil applied, or they may be dusted either with iodoform or with one part of salicylic acid and ten of starch. Sponges should not be used in bathing, but absorbent cotton or perfectly clean cloths, the cotton or cloths being afterward burned. The temperature of the room should be from 60° to 65°; the room must be well ventilated, but the patient is to be protected from drafts of cold air; all soiled clothing, napkins, etc., and urinary or fecal evacuations must be promptly removed so as not to poison the air by their exhalations. While care is taken that the patient is not chilled, the active state of her skin making her peculiarly susceptible to any sudden reduction of temperature, she ought not to be so carefully and heavily covered with bed-clothing as to make her uncomfortable and to increase the activity of the sudoriparous glands. The room is generally kept moderately darkened, in the interest of the mother to promote her rest, and in that of the child to prevent the supposed injurious effect of light upon its eyes.

Changes in the clothing of the puerpera are made from day to day as cleanliness and comfort require; it is important that all clothing, and especially garments that come in direct contact with the skin, should be dry and warm, though few would direct the method to secure this end advised by Hubert.[1] The exclusion of visitors during the first week materially assists in the convalescence of the patient.

Lactation—Care of the Breasts.—Moralists and obstetricians agree in urging the importance of the mother nursing her infant.[2] As a rule, she thus best secures her own and its health, she obeys nature's law and design, promotes the closest mutual attachment, and has an important influence in fashioning the first mental and moral development of her offspring. The prevalence of wet-nursing has been said to be the proof of a people's decline. Maternal nursing was once held in such high honor by some of the Romans that it appears no greater praise could be inscribed upon a mother's tomb than that found, according to Hubert, upon the tombs of many women dying in Hadrian's time:[3] *Filios suos propriis uberibus educavit.*

Obstacles to the Mother's Nursing.—Nevertheless there may be circumstances or obstacles arise which will forbid the mother nursing. First. The child may be illegitimate, and the mother, to hide her shame or to save it from disgrace, must part with it. Nevertheless it is better to nurse it during the first few weeks. Second. The poor quality or scanty secretion of milk may discourage the mother from nursing. But means may be used to increase the secretion and to improve the quality of the milk; and, at any rate, mixed nursing is better than a diet exclusively of artificial food—that is, let the child get all it can from the mother, then make up the deficiency by condensed milk or other substitute. Third. Vices of conformation of the nipple, or changes in the structure of the gland, the latter generally resulting from inflammation in a previous confinement, may render

[1] Hubert says that the chemise should be worn a day by the mother or the sister, or placed during a night in the husband's bed, before she wears it. Upon the page containing this suggestion he narrates from Dionis the well-known story in regard to Clement using for the dauphiness after her first labor the fleece of a black sheep, this fleece being placed just after its removal from the living animal upon the naked abdomen of the puerpera, and his not using it in her subsequent confinements. The butcher brought the fleece carefully folded in his apron to the bedside of the patient, but unfortunately had left the door open, and the fleeceless sheep, bleating and bloody, followed him, greatly to the consternation of the dauphiness and of the ladies present; this accident prevented the repetition of the custom. Clement's and Hubert's practice may be placed side by side.

Another curious fact is related by Dionis which shows that a medical sect of the present day had at least an illustrious example in the belief that odors, as of flowers, have an unfavorable effect upon the sick. "It is claimed that odors have a very injurious influence at this time; and persons who are perfumed are not allowed to enter the room of princesses or of ladies of rank. In the case of the dauphiness, the usher had orders to examine the ladies who came, and to send away any who were perfumed or had flowers." Traité General des Accouchemens, 1718.

[2] The late Mr. Darwin, in his Descent of Man, suggests the probability that during "a former prolonged period male mammals aided the females in nursing their offspring, and that afterward from some cause, as from a smaller number of young being produced, the males ceased giving this aid, disuse of the organs during maturity would lead to their being becoming inactive."

[3] Nevertheless in the time of Cæsar this custom was not general, since he reproached Roman women for carrying in their arms monkeys and dogs, while they confided their infants to mercenary wet nurses. *La Génération Humaine.* By Wiktowski.

lactation difficult or impossible. Fourth. Diseases of the mother which are aggravated by nursing, or will injure the infant through the milk, forbid her nursing. Thus, if the mother be exhausted by anæmia, or if she be suffering from phthisis, she ought not to; indeed, a marked predisposition to the latter is a reason for not nursing, since the statistics of Flint show that in 13.5 per cent. of married women under forty years who are phthisical, the disease is developed during lactation. If syphilis be recent the mother should not nurse, for then the probability is the child is not infected; but otherwise, that is, if the mother was syphilitic when she conceived, or acquired the disease in the first half of pregnancy, she may. It is criminal to employ a wet-nurse for a syphilitic child.

As far as the infant is concerned, it may be born prematurely, and be so feeble it cannot nurse at first; or it may be so deformed—as, for example, by harelip—or it may have been so injured in natural or in artificial delivery that it is unable to do so. In some cases the disability is only temporary.

If a woman is not to nurse she should have a less liberal diet until the secretion of milk disappears, and until then, too, a saline laxative should be given each day beginning with the third; the breasts may be covered with a layer of cotton-batting, which is to be frequently changed as it becomes wet with the mammary secretion or with that of the sudoriparous glands; in this, as well as in other cases, the gland may be supported when greatly enlarged by a properly applied handkerchief, the ends of which are tied over the opposite shoulder. Various popular as well as professional remedies have been recommended to stop the secretion of milk; among the former may be mentioned a piece of flannel saturated with spirits of camphor applied to each breast, and among the latter, iodide of potassium internally and belladonna locally. Generally all local treatment, except that which comforts the patient, is unnecessary, for the secretion stops if the milk is not required, for the great law of political economy is as true here as in the department of manufactures—if there is no demand there will be no supply—and possibly some if not all the remedies advised to arrest the secretion have no more virtue than one which Mauriceau[1] mentioned as being employed in his day.

In case the mother is to nurse, the child should be put to the breast eight or ten hours after labor. Some advise the first application to be made as soon after delivery as the woman has had the necessary attentions, while others would wait until the secretion of milk is established, alleging that an earlier application is vain as far as securing nourishment is concerned, that it wearies the mother, and renders her more liable to sore nipples. Immediate application should be rejected because the mother is so fatigued and needs rest, and a late one because of the difficulty of the child's nursing then, from the breast being so swelled that the nipple cannot be readily seized by it. While

[1] "I know some women who hold it for a very great secret, and most certain to drive the milk effectually back—and that is, to put on her husband's shirt yet warm, immediately after he had taken it off, and wear it until the milk be gone." (Op. cit.) Of course the valne of the remedy is indicated in the last words, "wear it until the milk be gone."

it is true that the infant gets little nourishment during the first twenty-four or forty-eight hours, yet it does get the colostrum which nature seems to have designed as a suitable laxative; moreover, it is usually satisfied thus, and is saved from having its stomach filled with improper food. It is probable, too, that the early and frequent removal of the contents of the breasts not only secures a proper formation, or drawing out of the nipple, but also leads to a gradual secretion of the milk, and thus local and constitutional disturbance from this cause is prevented. Certainly, if we follow the rule observed by the young of inferior mammals, the child will be put to the breast within a few hours after birth.

The breasts are carefully protected from cold by covering them with soft flannel or linen, which must be changed when it becomes moist. The infant, as a rule, should not be applied to each breast at one nursing, but to them alternately, thus giving the nipples as long a rest as possible between the times of nursing, until liability to inflammation has passed. The infant should not be allowed to sleep with the nipple in its mouth, for then it sleeps and sucks alternately, and its digestive organs are thus kept in almost constant exercise, and become disordered; but this practice is also very fatiguing to the mother, and the nipple thus kept constantly moist and heated, softening and desquamation of the epidermis follow with consequent erosions and fissures of the nipple, and thus the doors are opened for the entrance of germs causing, finally, inflammation of the breast.

After each nursing the nipple should be washed and well dried, and twice a day a little cocoa butter may be applied to it; if the nipple becomes sensitive, and especially if the slightest rawness or excoriation appears, the surface should be pencilled once or twice a day with compound tincture of benzoin; if this treatment does not suffice there may be conjoined with it lightly touching the tender surface with a twenty-grain solution of nitrate of silver, and the use of a nipple-shield—the best is Needham's; after the application of the tincture of benzoin the nipple should be left exposed until the tincture dries, and especially there must be no lint or a rag placed upon the surface, which of course can be removed only with the greatest difficulty at the next nursing. These details may seem to some unnecessary, but "sore nipples" cause so much suffering, and may lead to such serious consequences to both mother and child, that their prevention is of great importance.

During the first two or three days the infant, if comfortable, sleeps almost all the time, and once in five or six hours is as often as it needs to nurse; with the perfect secretion of milk the intervals must be shortened to two or three hours, endeavoring, however, to have the child nursed only twice in the night so as to secure the mother as long periods as possible of uninterrupted rest.

If the secretion of milk be scanty it may in many cases be increased by a liberal diet, especially by taking animal broths freely, chocolate and milk; if the last can be drank at the temperature it is furnished by nature, it is best; some women find that malt liquors increase the flow of milk when all other means have failed, and only under those circumstances should they be advised. Boiled beets eaten without

vinegar are one of the best of vegetable foods for increasing the mammary secretion. Various galactagogues have been recommended, such as the leaves of the castor oil plant applied to the breast, and different vegetable infusions, as of anise, and of fennel; faradization of the breasts has in some cases produced remarkably beneficial results. But these are not to be compared with suitable and sufficient food conjoined with regular rest and as entire freedom from care as possible, the use of moderate but not fatiguing exercise in the open air, and avoidance of anxiety; mental worry, bodily fatigue, and loss of sleep notably lessen the supply of milk.

Galactorrhœa may occur when there is polygalactia or excessive secretion of milk, and also when the secretion is normal in amount. As usually seen in the puerperal it is the former variety of the disorder, is only temporary, and generally yields to moderate compression of the mammæ, a restricted diet and saline laxatives.

De Sinéty refers to cases where the supply of milk is so abundant that several infants could be nursed, and weaning does not arrest the exuberance. Very great inconvenience results from this condition, for the breasts are painful and the constantly flowing milk requires several napkins a day for its absorption; finally the subject may become exhausted by the discharge, a condition formerly called *tabes lactea* resulting. Marvellous stories have been reported especially by Puzos,[1] as to the abundance of the secretion of milk. Borelli stated that a nurse had so great a supply she not only suckled two infants, but sold a large quantity to an apothecary who from it made butter for the phthisical. Ridley, a physician, said of his wife that she nursed twins, several small puppies, and then had enough milk escape from her breasts in twenty-four hours to make a pound and a half of butter.[2]

Kormann speaks favorably of hydrobromate of homatropine in galactorrhœa; and in that variety not associated with polygalactia of galvanism, and of the potassic bromide.

Diagnosis of Recent Delivery.—Very important questions in medical jurisprudence may arise in connection with childbirth. One of these relates to the evidence of recent delivery. If a primipara, the fragments of the torn hymen will be visible at the entrance of the vagina; the frænulum will almost invariably be found torn, and very probably more extensive injury of the perineum; the external genital organs are swelled, red, sensitive to the touch, and show various recent injuries; there is a bloody discharge from the vagina, and this organ will have injuries involving its mucous membrane, its rugæ are absent, and its calibre is so much increased that the hand can be introduced. In multiparæ all these signs may be wanting except the discharge and the capaciousness of the vagina, and the absence of rugæ, though almost always there will be swelling and redness of the external genitals. In many cases the vaginal walls prolapse toward each other, sometimes only one, the anterior. The "external os uteri is so open that half the hand can be easily introduced, and the walls of the cervix

[1] Traité des Accouchmens, Paris, 1759.

[2] It would appear from these illustrations that it is possible for a nurse, contrary to the opinion expressed in a recent poem, "Glenaveril," to be a *table d'hôte.*

hang down as a relaxed long uvula, and are marked by bleeding rents; the internal os will admit two or three fingers." The uterus is a round, hard body, readily felt by abdominal palpation; the abdominal wall has its central line of pigmentation, and laterally the bluish cicatrices of pregnancy may be seen, while if the woman be a multipara white cicatrices are also found. The breasts are swelled, the areola discolored, and colostrum or milk may be pressed out of the nipple. After seven or eight days external injuries of the genitals will be healed, but the lochial discharge remains, and the characteristic striæ and the pigmentation may be observed upon the abdomen and the breast; the uterus will be found enlarged. Kormann states that after the third week the question of recent delivery can hardly be answered with certainty. When the delivery was premature the difficulty increases with the length of time that should have elapsed before the completion of pregnancy, and if there are no external injuries the diagnosis will chiefly rest upon the lochial discharge and upon the increased size of the uterus.

The question as to whether a woman has ever given birth to a child has been considered on pages 199 and 200.

May the second stage of labor be so rapid in its progress or so sudden in its termination that a woman is taken by surprise, as it were, so that she cannot lie down upon the bed or on the floor, and the child born while she is standing, falls on the floor, receiving serious or fatal injury? Kleinwächter's answer is, that it may happen with a multipara whose soft parts are greatly relaxed and offer little resistance, the labor-pains very strong, the basin of normal width, or even somewhat greater, and the fœtus of the usual size; for several cases of this accident in which there was no question of medical jurisprudence involved have occurred. He regards it, however, as hardly possible in the case of a primipara. Yet it may be conceived as not impossible that a primipara alone, or without any intelligent person being present, may be deceived by the factitious desire to empty the rectum when the child's head is very low down (referred to on page 407), causing the patient to leave the bed for the water-closet, and the child being born there perish for want of proper immediate attention. Again, may a woman give birth to her child while she is in bed, and she be in such condition that the child perishes for want of proper attention, smothered it may be by the bed-clothes, or in consequence of its face falling directly into a pool of liquid between the mother's thighs? The answer generally made to this question is that such an event may happen in the case of a primipara, but not in that of a multipara. Yet it would be going too far to say that while exceedingly improbable in the case of the latter, it is necessarily impossible.

Attentions to the Child.—The care of the infant immediately after birth in case it should be in a normal condition has been considered. But if labor be premature or from other cause the infant is very feeble, it may be necessary to postpone the washing and dressing, and simply wrap it in warm cotton and surround it by bottles of hot water, or use other means to secure for it a normal temperature; it is then

too feeble to suck, and must be fed with milk from the mother's breast for some days.

Discharges from the Bladder and Bowels.—Some time in the first twelve hours the infant usually urinates. The urine during the first few days has a low specific gravity, and is quite pale. Apparent retention is generally non-secretion; for when the infant takes little or no food the quantity of urine secreted is necessarily very small. If there be actual retention and no urethral obstruction, a warm bath, followed by the application of cloths wrung out of warm vinegar to the hypogastrium has been recommended; the use of a catheter is very rarely necessary. Meconium, so named from its resemblance to the juice of the poppy, is usually passed a few hours after birth; but if the anus be not imperforate a delay of a day or two in this evacuation need give no anxiety; in case of longer delay a simple enema of warm water or of flaxseed tea may be used, or a little sweet oil given by the mouth. The third or fourth day the meconium usually disappears from the stools, and these gradually become a light canary-yellow.

The Umbilical Cord.—In three-fourths of infants born at term the stump of the umbilical cord falls off within five days, but in premature infants the time is longer. The raw surface left by its detachment does not cicatrize for eight or ten days; it may be washed daily with carbolized water, and afterward a carbolized ointment applied, or it may be dusted with calomel or with a simple absorbent powder.

Umbilical Hemorrhage, or Omphalorrhagia.—It has sometimes happened that a woman has given birth to her child while standing, and the infant falling to the floor the cord has been torn, or a similar tearing has occurred in forceps delivery, the cord being abnormally short, and in either case more or less serious hemorrhage followed. But the most frequent variety of umbilical hemorrhage observed is that which may happen several days after the birth and subsequent to the detachment of the cord. In forty-one cases collected by Minot[1] the average time was eight days; in four the hemorrhage began before the separation of the cord, in three immediately after, and in the others at periods varying from one to thirteen. Grandidier, quoted by Marduel,[2] states that in one case it did not begin until the fifty-third. In a large proportion of cases jaundice was seen; in some the hemorrhage was evidently dependent upon a hemorrhagic diathesis. The prognosis is quite unfavorable, for the great majority die in a time varying from a few hours to some weeks. In the treatment it is useless to trust to astringents and compression. The only plan which holds out hope of success is to pass a harelip pin or a needle through the skin of the umbilicus upon one side, then beneath the bleeding surface, and have its point emerge from the skin on the opposite side, and a second pin is passed beneath and transverse to the first; a figure-of-8 ligature is made around the projecting parts of each pin, and the entire mass ligated. The pins are removed on the fifth day, but the ligatures are undisturbed and left to fall off with the ligated mass.

[1] American Journal of the Medical Sciences, 1852.
[2] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, vol. xxiv.

Secretion of Milk.—The enlargement of the breasts in male as well as in female children, which with secretion of milk is sometimes observed a few days after birth, has been mentioned on page 88. This irritation in almost all cases spontaneously disappears in a few days; probably suppuration does not occur except in those cases where the organ has been accidentally bruised, or when injudicious nurses have rudely squeezed it in unnecessary efforts to force the fluid out.

Changes in the Shape of the Head—Caput Succedaneum—Cephalhæmatoma.—The alterations in the form of the cranium occurring in childbirth disappear in the course of a week, or a somewhat longer time, and nature is quite able to restore the original form without efforts on the part of the physician or the nurse to mould the head. The caput succedaneum, unless very large, usually disappears in a few days, and meantime if anything is done, it may be occasionally bathed with a solution of muriate of ammonia. It is only rarely that suppuration occurs, and then if the collection of pus be large it must be opened. In cephalhæmatoma absorption may occur in from ten to sixty days; suppuration is an occasional consequence, and recovery may follow the discharge of the matter; but sometimes necrosis of the bone and even perforation with resulting hernia of the brain is observed. Bouchut suggests in case of a large tumor which does not diminish in ten or twelve days under the application of a solution of muriate of ammonia, or of camphor, or of an alcoholic mixture, the evacuation of its contents by an aspirator.

Jaundice.—In many infants, as a consequence of great hyperæmia of the skin, very free desquamation occurs a few days after birth, and the skin gradually acquires a jaundiced hue, but this is not true jaundice, for there is no discoloration of the sclerotic. True jaundice is not uncommon, especially in children prematurely born, or otherwise feeble, or in those that have been exposed to cold, as is the case with many foundlings. This is manifested the second or third day, and usually disappears spontaneously.

According to Hofmeier,[1] every infant lives for a time upon its own organism on account of insufficient nourishment being provided immediately after birth; this is accompanied with degeneration or decomposition of albumen and red corpuscles. Bile pigment is formed from the pigment of the latter. At the same time the activity of the intestinal canal causes a great increase in the amount of bile secreted, so that the quantity is larger than that excreted after a certain degree of intensity has been reached and icterus neonatorum results, or if the skin be not colored, bile may be found in the urine.

Bouchut[2] regards hepatitis, of which one of the manifestations is jaundice, as very common in the new-born, its causes being compression of the body or contusion of the liver in labor, the impression of air upon the external surface, and umbilical phlebitis caused by ligating the cord, and extending to the hepatic veins. In eight or ten days the jaundice disappears.

But in the malignant form of jaundice there are fever, swelling of the abdomen, and tenderness in the right hypochondrium with enlargement of

[1] Kormann. [2] Op. cit.

the liver; there may be nausea and vomiting, and in some cases epistaxis, purpura, or hæmatamesis. The respiration is difficult, hiccough frequent, and as M. Richard points out, when this state is prolonged or increases, a profound change of expression follows, the eyes are fixed, convulsions affecting the muscles of the face and of the limbs occur, the infant sinks into collapse, becomes cold and dies. Bouchut states that he does not know a single case of recovery from malignant hepatitis.

Bathing—Sleeping—Nourishment.—An infant should have a bath once in twenty-four hours, in order to insure that perfect cleanliness upon which its health and comfort so greatly depend. It should not be accustomed to sleep in the nurse's arms, nor in the mother's bed, but in a separate one. As previously stated, it should be applied to the mother's breast eight or ten hours after birth. It ought, as asserted by Kleinwächter, to be subjected to a definite order in suckling from the beginning. After the secretion of milk has become abundant, generally the third day, "the child may be put to the breast every two hours, for at that time the capacity of the stomach is not great; after four or five days, once in three hours, and at night there should be an interval of six or seven hours; later on, six applications in twenty-four hours will suffice."

The child, as a rule, loses weight during the first few days; the loss is from 150 to 200 grams, and is to be attributed to discharge of urine and of meconium, and also to the scant supply of nourishment; at the end of the first week the child weighs nearly or quite as much as it did at birth.

If any food is given the child before it can get an ample supply from the mother's breast, it should be simply a little sweetened water, or properly diluted cow's milk; all farinaceous articles of food, especially the "cracker tea," which some nurses are so much disposed to give, ought to be forbidden the new-born.

Milk Tests.—The best proof of the good quality and of the sufficient quantity of the milk, whether of wet-nurse or of mother, is given by the thriving of the infant. If the child grows well, is plump and healthy, it must have good and abundant food; the old law, "by their fruits ye shall know them," is here quite applicable. Nevertheless, other means may be mentioned. When the infant is at the breast it can be known that it is getting milk readily by the movements of the cheeks alternating with those of swallowing; the last is often accompanied by a sound which Hubert compares to that made in uttering the French word *glou-glou*. So, too, if the milk is abundant it is found in drops[1] at the angles of the mouth or upon the adjacent part of the cheek, after the child has finished nursing.

Naegele gives the following signs as indicating the good quality of milk: (1) White color; sweet, agreeable taste, and absence of odor.

[1] The most gifted poetess of the century, if not of all centuries, Elizabeth Barrett Browning, has alluded to this where she speaks of the babe "knowing all things by their blooms, not their roots," etc.:—

"And human love, by drops of sweet
White nourishment still hanging round
The little mouth so slumber-bound."

(2) A drop of milk placed upon the finger-nail held obliquely flows down, leaving a whitish trace. (3) Upon letting the milk fall drop by drop in a glass of water, each little drop causes a white cloudiness, which is insensibly dissipated. (4) The milk has an alkaline reaction, and presents under the microscope a large number of milk-globules.

Kleinwächter commends the test proposed by Bouchut—counting the number of milk globules. A drop of milk is mixed with 100 drops of a one-per-cent. solution of common salt; a drop of this mixture is placed under the microscope, and if the milk be good each square millimetre ought to contain 800,000 to 1,000,000 of milk globules.

Selection of a Wet-nurse.—The most desirable age for a wet-nurse is from twenty-two to thirty-five years. If a married woman, it is better that she should be multipara, for the milk is then not only more abundant, but she is less liable to suffer from disease of the nipple, or mammary inflammation, and, moreover, has acquired useful experience in the care of an infant. If unmarried, she ought to be a primipara, for, as suggested by Hubert, while the first fault might be excused, after the commission of a second there would be no guarantee that a third might not occur while she was nursing.

Delore states that from the time of Ambrose Paré blonde women were considered inferior nurses, and indicates that brunettes are generally preferred as habitually more vigorous. Dionis has stated that the best nurses are those of a sanguine temperament, and who have black, or brown chestnut hair. Bad nurses are those of a bilious or melancholic temperament, and who have blonde or red hair.

She must be free from syphilis, tuberculosis, or exanthematous disease. There ought not to be a difference of more than two months between the birth of her own and that of the infant she nurses. The breasts should be of medium size, and the nipple free from excoriations, of such size that the infant can readily grasp it with its mouth, and the milk be easily drawn. As a rule, a woman who menstruates regularly ought not to be taken as a wet-nurse. Supposing everything favorable as to the supply of milk and the physical health, consideration should be given to her moral character and disposition, for while it is true that the milk of the nurse[1] can transmit no intellectual or moral qualities to the nursling, yet it is also true that with the development of the infant's intelligence it will receive in its plastic nature impressions more or less profound and permanent from one

[1] The belief that the milk which nourished the new-born had much to do with the formation of the character is an old one; even to this day it is not uncommon to hear one speak of having sucked in with his mother's milk certain beliefs or principles, especially those of a religious character; but the expression is used more as a figure of speech to indicate how completely and thoroughly those beliefs or principles are interwoven with his spiritual nature, having been taught him in the very dawn of his intelligent existence, than that they came by the nourishment derived from the mother. The famous Cato, however, did believe that affection might be thus communicated, for, acccording to Plutarch's statement, he had his wife, whenever she nursed her son, also give her breast to the infants of her slaves, so that sucking the same milk they might have an affection for him. Cruelty of disposition was also thought to be derived from the first nourishment. Thus among all the bitter reproaches which the deserted Dido cast upon the escaping Æneas, one of the severest, as indicating his cruel nature, was that he had nursed the breasts of Hyrcanian tigresses. Gardien quotes the statement that if young lions are nourished by cow's milk they are gentle, and, on the other hand, that if puppies are brought up by wolves they are fierce.

with whom it is so intimately and constantly associated as the nurse. Moreover, the question as to her disposition is an important one, since for the time being she is to some degree a member of the family; taking the child to her own home to nurse is quite exceptional.[1] Further, it is generally admitted that the milk may at once undergo important modifications in consequence of profound mental emotion. Devilliers remarks that it would be easy to adduce examples of nurses in whom violent passions, especially anger, changed the qualities of the milk so as to disturb the health of the infant, and even cause severe convulsions. And he adds: "A thousand times better a woman somewhat stupid, of an impassive character and almost insensible to passions, than a nurse with intelligence more developed, but of a passionate and choleric character."

Artificial Feeding.—If it be impossible for the child to obtain nourishment from its mother, and if a wet-nurse cannot be procured, the only alternative is artificial nourishment. In cities this substitute will be in many cases condensed milk, and certainly it will be found to produce less disorder of digestion in the majority of infants than any other form of artificial food. Lusk states that he has seen a number of children exclusively fed on it, after passing through apparently a blooming infancy develop symptoms of rickets at the end of the first year; nevertheless he states that he is in the habit of allowing its use during the first three months, and in the city during the hot months of summer. Galabin makes a remark similar to that of Lusk, as to the tendency of a diet of condensed milk to cause rickets. I have never seen any proof of the fact, but the common statement of two such eminent authorities ought to make the physician cautious in advising it. In the country where the milk from one cow can be obtained fresh morning and evening, it will prove the most available substitute for human milk; the milk of the Jersey cow should not be used, for it contains too much butter. Cow's milk should at first be diluted with an equal quantity of water (gum arabic water, gelatin water, and after a few weeks barley water, or thin, strained oatmeal gruel may be usefully substituted for the water), sugar of milk and lime-water in the proportion of a tablespoonful to four ounces added, and the mixture brought to the temperature of the body, and then taken by the infant through a nursing bottle.[2]

Dr. J. M. Keating, in referring to the importance of adding lime to artificial food, states that he prefers the soluble lactophosphate, having used it largely with success for some years, and gives the following directions as to preparing milk for infants: "To make this matter simple and to facilitate the carrying out of instructions, I have had compressed *tablets* (*Milk Food Tablets*) made, each containing:—

Sugar of milk	26 grs.
Calcis lactophos.	⅙ gr.
Calcis carb.	1½ gr.
Sodii bicarb.	½ gr.
Potass. bicarb.	1½ gr.
Sodii chloridi	⅙ gr.

[1] This seems not to have been extraordinary among the Egyptians, as the story of Moses' infancy shows.

[2] Philadelphia Medical News, June 5, 1886.

These can be made up in large quantities, put in cans or wide-mouthed bottles, and are to be used as follows:—

To prepare the bottle for a child about a month old or younger, take three ounces of boiling water and stir in one ounce of ordinary milk; to this add three tablets and dissolve thoroughly; place the mixture in a nursing bottle and add two tablespoonfuls (one ounce) of good, fresh cream; shake well, and give to the child at about the temperature of the body.

For a child two or three months old, prepare the bottle as follows:—

Take two ounces of water (boiling) and stir into it two ounces of good, fresh ordinary milk (if the child is of a constipated habit, they need not boil together); then dissolve into the mixture four tablets, pour this into the nursing bottle, and add one ounce of fresh ordinary cream; shake well.

If the child's stools contain a mass of curds, showing deficient digestion, it would be well at once further to dilute the milk. Should this not be sufficient a small quantity of malted food, such as Mellin's or Horlick's, a teaspoonful to the bottle, can be added to stimulate the digestive functions. If this fail, then use *peptogenic* milk powder, and predigest the curd; and, finally, if still unsuccessful, put the child on condensed milk."

Concluding Remarks.—In closing this chapter devoted chiefly to childbed and its management, a few additional directions are to be given. The physician ought, if practicable, to visit the puerpera daily for the first week, and afterward occasionally during the next three or four weeks. At each of his earlier visits the general appearance and condition of the patient should be observed, careful inquiry as to the character and quantity of the lochial flow made, and in many cases when there is the slightest indication of an unfavorable condition of the patient, it is better for him to examine the soiled napkins himself, for he can more readily detect an offensive odor, for example, of the lochia, than the nurse who is constantly in the room can. If the discharge be found offensive, antiseptic vaginal injections, which are best given by a fountain syringe, must be at once directed, and if they fail to promptly correct the condition, he must himself employ intra-uterine injections.

After the first ten or twelve days a daily warm vaginal astringent injection may be used with advantage. The practitioner should carefully note the pulse and the temperature, and ascertain by placing his hand upon the abdomen whether uterine involution is progressing favorably. He should be watchful as to the condition of the breasts, the urinary and the digestive organs; look after the health of the infant, and ascertains that it is properly nourished; he should as far as possible carefully guard the mother against all injurious influences which may hinder her convalescence, and especially insist upon the necessary rest in bed which is so important in securing restoration from the injuries of childbirth, and normal uterine involution.

CHAPTER II.

THE PATHOLOGY OF THE PUERPERAL STATE—TETANUS—MENTAL DISORDERS—DISEASES OF THE NIPPLE AND BREAST.

Puerperal Tetanus.—In Sir James Simpson's[1] article upon puerperal tetanus, published in 1854, he refers to the fact that ancient authors, of whom he mentions Archigenes and Areteus, stated that tetanus sometimes followed abortion. Garrigues says that the first case of puerperal tetanus which he finds recorded in modern times was by Currie in 1793. Velpeau, in 1833, reported one of tetanus following labor, and previous to this Fournier-Pescay had indicated the same etiology. In 1839 Dubois performed the Cæsarean operation upon a woman who seventeen days afterward died of tetanus. In 1842 Dr. D. Humphrey Storer reported[2] a case of a woman who died from tetanus after delivery; this was of especial interest from its being associated with retained placenta; Dr. Storer stating that the placenta throughout its whole extent adhered so firmly to the uterus that he could not detach it in the slightest degree. The historical references to the subject, as well as a description of the disease, have been very well presented by Hervieux;[3] but probably the most complete article upon puerperal tetanus, certainly the most complete in the English language, is by Garrigues.[4] He has collected 57 cases, 25 of them following abortion, and these 25 include 7 reported by American physicians, to wit, Gordon, Banga, Frost, Thompson and Maclay, and Green. The affection is not a frequent one; Kormann[5] says that only three instances have been observed in Germany, the first being reported by Osiander in 1833. Garrigues mentions among the causes of the affection a hot climate as predisposing to it, and that the colored races are more liable to it than the white. He also regards an advanced age as a predisposing cause; other causes are mental excitement, hemorrhage, exposure to wet and cold, and obstetric operations. Poncet[6] says that the disease does not occur in the first days following delivery, but about the eleventh day, when the woman seems to be in full convalescence; but in consulting Garrigues's statistics it will be seen that the time varies from two days to a month; the most frequent periods were five, six, seven, and eight days.

The disease begins by dysphagia and trismus, and follows the ordinary evolution. The pulse, notwithstanding the puerperal state, is small, frequent, and irregular in the paroxysms, and becomes regular in the intervals. There is the same intellectual calm, and the same

[1] Edinburgh Monthly Journal of Medical Science. 1854.
[2] American Journal of the Medical Sciences, Jan. 1842.
[3] Op. cit.
[4] American Journal of Obstetrics, 1882.
[5] Op. cit.
[6] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome trente-cinquième.

form of opisthotonos as in traumatic tetanus. Cartier mentions that in some cases there is incontinence of feces and urine. Poncet[1] also states that the disease lasts from three to six days, and if beyond seven cure is the general rule. "Puerperal tetanus is of short duration. It may put an end to the patient's life in a few hours, and very few who are attacked live beyond eight days. Of 22 abortion cases, 19 lasted from 1 to 8 days; of 25 parturition cases, 22 came to an end within the same brief space of time. The longest time observed in our cases is, for abortion, 'more than a month;' for parturition, twenty days."[2]

The prognosis is, of course, bad. In the 25 abortion cases given by Garrigues a fatal result occurred in 23; in the 32 parturition cases 37 died and five recovered.

Treatment.—The same constitutional remedies are used as those employed in traumatic tetanus, and probably the most valuable are chloral, curara, and nitrite of amyl. Kormann advises hot-water compresses to the back of the head and to the spine, subcutaneous injections of curara, of morphia, and of the hydrobromate of conine, inhalation of chloroform with the addition of amyl nitrite, or the latter alone, and clysters of chloral every four hours, and calabar bean papers placed between the teeth. During the intervals between the paroxysms large doses of the potassic bromide and chloral are given by the mouth. Garrigues, in considering the subject of local treatment, remarks that as in several autopsies more or less of the placenta has been found in the uterus, curetting would seem to be the first indication if there is the slightest evidence that the delivery has been incomplete. He would follow the use of the curette by warm-water injections of a two per cent. solution of carbolic acid.

Mental Disorders.—It is usual to include under the general term puerperal insanity the mental disorders which may happen in pregnancy, in labor, or during the puerperal state, or during lactation.

(A) *Insanity of Pregnancy.*—This is very much less frequent than that occurring either in puerperality or during lactation; it was observed by Marcé in only 27 out of 310 cases of "puerperal insanity," and by Tuke in 28 out of 155.

Pregnancy increases the nervous sensibility, and it is not uncommon for a woman during it to suffer from more or less mental depression. As observed by Hervieux, this condition of body and mind is aggravated in some women by the shame for a fault committed, and which they wish to hide at any sacrifice; in others, by preoccupations and anxieties resulting from their limited means; in this one, by the anticipation of unknown suffering and the fear of not being able to endure labor; in that one, if she be a multipara, by the memory of the past and the prospect of the future; and in others, by the fear that the child will be hideous or deformed.

Among the actual causes of the disease heredity plays an important part. Esquirol stated that he found it in five out of thirteen cases. Previous attacks, exposure to cold, anæmia, improper regimen, and intestinal disorders are also mentioned among the causes; but moral

[1] Op. cit. [2] Garrigues.

are more frequently observed than physical causes; according to Esquirol the former are found four times as often.

The disorder may recur in successive pregnancies. Voisin[1] refers to one instance in which it was observed at the beginning of seven, and in another of ten pregnancies. In more than one-half the cases the disease is manifested within the first half of pregnancy. It presents two forms—mania and melancholia—the latter being much the more frequent. When the insanity of pregnancy has the maniacal form there are more or less active excitement, irascibility, loquacity, habitually without hallucinations, and without true delirious conceptions.[2] Sometimes, however, the subjects are affected with erotic delirium, which is manifested by the most obscene words and conduct, even on the part of refined women. According to Voisin the mental alienation may take a melancholic form, with partial delirium, sad hallucinations, dipsomania, and moral insanity; ideas of suicide and of infanticide are very frequent, but mania rare. He mentions a woman who in all her pregnancies had kleptomania; Georget one, the mother of five children, who when five months pregnant threw herself into a well; and another who during her pregnancy endeavored to poison her husband.

Prognosis and Treatment.—The prognosis is more favorable in melancholia than in mania. Marcé's statistics show that of nineteen, seven recovered after delivery, two during gestation, one became worse during labor and died soon after, while in nine the disease remained incurable, or at least had not disappeared a long time after childbirth. In the treatment neither the induction of abortion nor of premature labor is indicated, but this should be at once symptomatic and expectant.

(B) *Insanity during Labor.*—It is not strange that sometimes from the intensity of suffering in the agony of childbirth reason should temporarily be lost, and the woman give way to delirious words and acts. She may become forgetful of all proprieties of speech and behavior, resent the assistance of those around her, "curse the father of her child, and the child too, and uncovering her person with her hands seek to tear open her external genitals." Osiander mentions the case of a woman, who in the midst of the pains of childbirth demanded that her abdomen should be opened, and seized a knife for this purpose; Joërg that of a negress who, seized with delirium in a long and painful labor, opened her abdomen, extracted the child, and recovered. Winckel says that while attending a primipara in the second stage of labor, when the head was pressing upon the external genital organs and he was supporting the perineum, "she suddenly raised her right hand and struck me so stout a blow upon the back that it resounded through the chamber, and caused great alarm to the midwife." Hervieux mentions that when attending a primipara she suddenly sprang from the bed and attempted to throw herself out of the window.

As a rule the insanity of labor ceases with delivery. The role of the practitioner is to prevent the patient from doing harm to herself or

[1] Leçons Cliniques sur les Maladies Mentales. Paris, 1883. [2] Hervieux.

to others, to mitigate her physical suffering by an anæsthetic, and to hasten delivery by version or by the forceps if the labor is prolonged.

(C) *Insanity of the Puerperal State.*—In nearly one-half of those who become insane soon after labor, heredity is a factor. Moral causes, too, are potent.

Morel, quoted by Hervieux, gives some striking illustrations: A woman, endowed with excessive sensibility, lost her child after a tedious and difficult labor, she received the information without apparent emotion, and seemed in a state of stupor; her eyes were fixed and injected, her forehead burning, and the rest of her body cold. Suddenly she cried out "My child! give me my child." Delirium seized her, convulsions rapidly followed, and in twelve hours she was dead.

A woman was brought to *Hôtel Dieu* the day following her delivery. In being conveyed to the ward to which she was assigned, she saw the word *amphitheatre*. This word, which suggested to her ideas of dissection, threw her into the greatest anguish. A prey to the most violent delirium she dreamed only of murder, of assassins, of butchers, refused all nourishment, and died in two days.

A husband threw a bucket of cold water upon his wife, who had recently been delivered; she soon became maniacal, and did not recover.

Another husband struck his wife in the face after her fourth labor. She having for sometime hidden her sorrow and borne up against her domestic trials without the world knowing, ran into the fields half-naked on a cold winter night, and was attacked with acute suicidal mania. She repeated only these words: "Mon Dieu! Seigneur! Mon Dieu!" Brought to *Salpêtrière* she attempted to strangle herself. After appropriate treatment she recovered her health. (Falret.)

According to Bérard, Esquirol, and others, moral causes are observed more frequently in the higher classes of society, and physical in the lower. In addition to heredity and moral causes, others are anæmia, which may have been present in pregnancy, or may be acute from hemorrhage in connection with labor, or from exhaustion by lactation, poor and insufficient nourishment, hard work, want of rest, and unhealthy homes. Multiparity is also a cause, and age, the greatest number being from twenty to thirty years old. By some it has been thought that insanity is more liable to occur after male than after female births, and in general after difficult or prolonged rather than after brief and easy labors. Charpentier regards the former as not proved, and Marcé denies the latter.

Voisin states that this insanity depends most frequently upon anæmia, and is usually manifested within the first six weeks, rarely after the second month; occasionally, however, the disease may be congestive in character, as when there is a sudden suppression of lactation. A connection between albuminuria and the disease has been indicated by Sir James Simpson; he found the urine albuminous in four cases of puerperal mania.

The disease may occur as mania or melancholia, or monomania, the first being much the most frequent. In case of this variety of puerperal insanity the prognosis should be guarded, though probably more than one-half the patients recover. Voisin regards the prog-

nosis as grave, for either the disease may end in the first days by death in the delirium and during the period of excitement, or to this period there succeeds a period of adynamia which may end in death from coma, or finally the disease may terminate in mental alienation. The prognosis of monomania in women in childbed is, according to Hervieux, never grave. Recovery from mania generally occurs within two or three months, but from melancholia not for six or seven.

In the treatment of most cases, as the disease is associated with anæmia, the administration of tonics, especially of iron, is indicated. Nutritious food should be given, all sources of mental irritation as far as possible removed, and rest secured. For the end last mentioned it may be advisable to give chloral with the potassic bromide; in mania opium is not indicated, but it may be given in melancholia. Kormann advises in severe maniacal attacks, resulting from cerebral anæmia, amyl nitrite or chloroform by inhalation. Voisin states that in all cases one medication is invariably indicated, and that is a blister to the nucha, when the disease does not have a favorable issue in six to seven weeks, in order to oppose by this active revulsion serous and plastic exudations which very often occur in the encephalon. Many cures of melancholia may be effected by a complete change of scene with prolonged absence from home.

(D) *The Insanity of Lactation.*—This may appear six or seven weeks, or several months after labor, or finally a few days after ceasing to nurse. It may be manifested under any one of the forms, mania, monomania, melancholia, or insanity with a double form, "circular insanity," all "accompanied with hallucinations and impulsive ideas, and homicidal or infanticidal tendencies."

The prognosis is favorable, most cases recovering if the child be weaned. Marcé saw 20 cured out of 26; but the cure may be slow, and may not occur for several months, or even for years (Charpentier). In case the disorder follows suspension of lactation, cure has been effected by its resumption.

Diseases of the Nipple.—Diseases and injuries of the nipple are liable to occur in the first days of lactation, especially if a suitable prophylaxis has not been employed in pregnancy, and when errors are committed in nursing. Abrasions, excoriations, or erosions usually have their origin in erythema, eczema, or in ecchymoses, or from a want of proper cleanliness, or from keeping the nipple constantly moist, as when the infant is allowed to have it in its mouth too continually. or when there is galactorrhœa. The mechanism by which ecchymoses are formed upon the summit of the nipple is precisely like that which causes the caput succedaneum; it will be remembered that the latter is found upon that part of the child's head which was not subjected to pressure during labor, and so these subcutaneous hemorrhages occur upon that part of the nipple which is not pressed by the infant's mouth in sucking. Ordinarily when the infant sucks the milk readily escapes, and the accident does not occur, but if the child be vigorous and very hungry, and the supply scanty, it may. Following the ecchymosis the epidermis is detached and an abrasion results. Whether the abrasion arises from this or other causes it may result in

a fissure; these fissures situated usually upon the summit of the nipple are irregular in form, and in some cases penetrate so deeply that some discharge of blood may occur in nursing. Other fissures are found at the base of the nipple; the absence of sebaceous glands at this part is probably a predisposing cause, but the active cause is injury in nursing, this injury in some cases resulting from the violent compression of the part by the infant irritated by pain or by disappointment at not getting prompt or adequate supply to satisfy its hunger; there may be a malformation of the nipple, or independent of this, there are infants who have, as Rollet has said, a murderous mouth, and who suck with such violence that the soundest and best-formed nipple soon becomes diseased; from violent compression of the nipple, from bruising or dragging the nipple at its base, an injury is done which causes a fissure. These fissures are semilunar, and tend to grow deeper and extend around the nipple; in their progress a milk-duct may be opened, and a milk fistula results; in some cases they result in partial, in others in complete amputation of the nipple. An occasional consequence of lesions of the nipple is an extension of inflammation to the connective tissue of the areola with the formation of an abscess. A more frequent result is mastitis, for, while it is possible that this affection may come from inflammation propagated by the milk-ducts, such an event is very rare, and in almost all cases it is preceded by disease of the nipple, for an abrasion, ulceration, or fissure of the nipple is a door opened for the entrance of septic germs.

The immediate suffering caused by these affections is often very great; instinct and duty seem to require that the mother should give her infant the breast, but what suffering agony the compliance causes! The tears often come to her eyes even if she does not cry out with the pain while the child is nursing. In some cases considerable hemorrhage occurs, and the child swallows a mixture of blood and milk—the fable of the pelican nourishing her young with blood from her breast being in part repeated; after nursing under such circumstances it is not unusual for the infant to vomit blood.

Blondes with a delicate skin are peculiarly liable to disease of the nipples. Winckel, who found such disease in rather more than one-third of puerperal women, regards it as quite as common in multiparæ as in primiparæ, but it is probable that this is an error,[1] for it is natural to think that the nipple ought to be in a second nursing better disposed to affront the violences which it endures from the infant, and the woman more experienced so as to guard against the causes that may injure it.

In consequence of the irritation and suffering fever may result. "Von Gruenewaldt found that in lying-in-women, temperatures of 100° to 104° F. are met with which are attributable to fissures and excoriations of the nipples." Schroeder states that while fever does not occur in the majority of cases, in others the temperature may rise to 104° or higher.

Treatment.—The prophylaxis has been sufficiently considered in

[1] Rollet.

connection with the subject of the management of pregnancy and in the directions as to nursing. Should erythma occur, the surface may be covered with lint dipped in lead-water, careful washing preceding the following application of the child to the breast. When there is an abrasion the application of the compound tincture of benzoin two or three times in the twenty-four hours is indicated, and if this fails the solution of nitrate of silver may be conjoined, this being applied once a day. It is important that the nipple be given as long a rest as possible between the applications of the child—six or seven hours at least. The use of a rubber shield should be insisted upon; Cazeaux suggested that, in order to overcome the repugnance of the child to nursing the artificial nipple, the latter should be filled with warm milk and then inverted over the nipple, the infant draws without difficulty this milk and will continue sucking so that the milk of the mother follows. It is unnecessary to mention all the applications that have been advised for these affections of the nipple, various astringent lotions, as of alum, nitrate of lead, sulphate of zinc, tannin, etc., and a two per cent. solution of carbolic acid. According to Winckel, Bourdel and Anselmier tried benzoin, both in powder and in tincture, and claimed good results. He also mentions Legroux's plan, which was painting the raw spots with collodion, castor oil, and oil of turpentine (30, 5, 1.5 parts), and afterward covering the nipple with gold-beater's skin, perforated with pin-holes over the apex of the organ, the covering to be softened with sugar and water before the child nursed.

In my hands the plan has proved a failure if not an injury, for there remains after each nursing some milk in contact with the nipple, the result of which is softening of the epidermis; or, which decomposing, irritates the raw surface, and it is quite impossible to keep a nipple thus covered well cleansed.

Fissures may be treated by a five per cent. solution of carbolic acid, by nitrate of silver in solution or in substance, in the latter case the stick of caustic is given a fine point which is quickly applied to all parts of the fissure. Ahlfeld has had good results from the application of ice, placed in a small sac, to the deeper fissures, and employs for the large circular ones at the base of the nipple, a suture. Of course a fissure of any extent renders nursing impossible or unadvisable; indeed in many cases of simple abrasion healing is impossible as long as the infant is given the breast every few hours. Hence discontinuing, for the time at least, nursing from the affected breast is indicated in such cases; the indication is still stronger if mammary inflammation is threatened.

Inflammation of the Breast.—Three different forms of mammary inflammation are usually described as occurring in the puerperal woman, though probably all have the same etiology. First. There may be inflammation of the superficial connective tissue of the breast, sometimes distinguished as supra-mammary inflammation. It generally originates in the subcutaneous tissue of the areola, rarely becomes extensive, usually forms a tumor about the size of a walnut, and ends in an abscess. In most cases it does not cause much suffering, and may not prevent nursing. Of course the abscess should be opened as soon as the formation of pus is distinctly recognized.

Second. In rare cases the connective tissue between the gland and the thorax is inflamed, and the result generally is extensive suppuration; the inflammation is known as submammary, or simply as paramastitis. The gland is lifted up, and after suppuration has occurred seems to be resting on a layer of fluid or upon a sponge. An early opening followed by thorough drainage is especially indicated.

Third. The form of inflammation most frequently affecting the breast, or true mastitis, is usually described as parenchymatous mastitis. In the great majority of cases the disease occurs within the first four weeks after labor, and involves the connective tissue rather than the glandular structure, at least primarily; Klob states explicitly that the suppuration begins in the connective tissue, inasmuch as he has not detected in these cases anything pointing to epithelial suppuration. The advent of the disease is generally marked by a chill which is followed by increase of temperature and of the frequency of the pulse; the breast is the seat of sharp shooting pains, and one or more lobules will be found hard, irregular in form, and sensitive to pressure. The more superficial the inflammation the more probably there will be seen fine red lines proceeding from the vicinity of the nipple, and indicating lymphangitis, but these are not present if the disease be deep seated. In almost all cases of mammary inflammation the disease is a lymphangitis, and arises from the introduction of septic matter through a wound of the nipple. Nine times out of ten, Sappey has said, mammary angeioleucitis begins by a crack, a fissure, an erysipelas, in a word, some irritation seated at a point of the nipple or of the areola. It is not unusual in severe mastitis to find the axillary glands swelled and sensitive. The inflammation may extend from one to another of the lobules of the breast until the greater part of the organ is involved. Resolution occasionally is the end of the inflammatory process, but oftener suppuration, which occurs in about two weeks from the first manifestation of the disease. It is without danger in almost all cases to the mother, but from its preventing nursing may have very serious consequences to the child. Metastatic mammary abscesses may occur in puerperal septicæmia, but they do not add to the gravity of the disease. In regard to its etiology but little need be added to the statement incidentally made in regard as to the connection between the disease and a lesion of the nipple. It is only exceptionally that such a lesion has not preceded or is present in puerperal inflammation of the breast.

Bumm[1] has reported a case which seems to sustain the view upheld by Speigelberg that the infectious agent in mammary inflammation may enter through the milk ducts. Even if in this case such entrance occurred, such an event must be quite exceptional or mastitis would be more frequent. Moreover there might have been a lesion so insignificant as not to attract attention, yet quite large enough to admit septic germs.

Treatment.—Rest for the affected organ is of the greatest importance; this rest includes not only giving up nursing from it, but also all ap-

[1] Archiv für Gynäkol.

plications of the breast-pump and rubbing to get rid of the milk under the mistaken notion that it is the source of the mischief, or at least aggravates it. A saline cathartic may be given, and if there be much fever ten to twenty grains of quinine. Belladonna or its active principle, atropia, is a favorite local application with many. Bartholow[1] advises enveloping the breast in lint wet with a solution of atropia in rose-water, four grains to the ounce; he adds the caution that as systemic effects may be produced by such an application, when the pupils dilate and the mouth becomes dry, it should be removed. Pain may require the administration of opium or of morphia. The breast ought to be properly supported by a bandage even if the treatment by compression, to be mentioned in a moment, is not employed. In all local applications warmth is to be avoided as long as there is hope of preventing suppuration; but should this occur, as shown by occasional chills, and the swelling becoming soft and superficial, warm poultices may be applied. An early opening should be made with proper antiseptic precautions when an abscess has formed, and after drainage the healing of the abscess cavity and the removal of all engorgement will be best secured by a compressing bandage. This application may be made still more efficient by conjoining the use of a compressed sponge.[2] Take a large, flat sponge that will completely cover the mammary gland, and after it is thoroughly cleaned, put it in a letter-press for a few hours, or otherwise secure its compression; then place it over the breast, which is first covered by a layer of cotton batting, and apply a bandage. After the application of the bandage a little water is allowed from time to time to pass through the bandage, moistening the sponge which consequently swells and thus more and more compresses the gland, bringing the abscess walls in perfect contact.

Billroth, Kormann, and Kucher advise the introduction of a drainage-tube.

The directions of the last, given in his very useful work,[3] as to opening the abscess and introduction of the drainage-tube are as follows: "The opening should be made under anæsthesia, as without this it can hardly be as exact as is necessary. A careful incision in a radial direction, through the integument and fascia, is made so as to expose the tissue under which the abscess lies, then a director is pushed through this tissue into the cavity of the abscess and a dressing forceps pushed along the groove of the guide into the cavity, the blades opened wide and the tissues separated so that free exit is given to the pus. A finger is introduced into the cavity and a drainage-tube inserted. If a recess be found from which pus cannot flow by its gravity, a counter-opening at the most dependent point is absolutely necessary, otherwise the retained pus will decompose, cause chills, and form fistulous openings. A simple counter-opening often shortens the disorder for weeks. If there are several abscesses in the gland, each of them must be treated in the same manner." He further states that injection of pure water or some weak antiseptic solution should be made every day, and that the drainage-tubes may be removed from the fifth to the tenth day, if no pus is found upon the dressing or brought out by the injection.

[1] Materia Medica and Therapeutics. [2] Gross's Surgery.
[3] Puerperal Convalescence and the Diseases of the Puerperal Period.

Dr. Hiram Corson strongly advocates[1] treating mammary inflammation by applications of ice, stating that during twenty-seven years in which he has employed it, he has failed in no instance to disperse the inflammation, if suppuration had not already occurred, and at the same time brought comfort to the patient. He states, "There is no better way to apply the ice than to put it into a bladder with just enough water to float it, or just to form a water cushion, that will fit the inflamed part nicely. It is not necessary to put two thicknesses of muslin between the bladder and the breast, it is not too cold without any, but a single thickness is useful to keep the bladder in place more readily."

Dr. P. A. Harris advises[2] treating mastitis by bandaging and rest. He speaks as follows of the plan of treatment: "Having discovered the existence of an inflammatory movement in the breast, of any grade of severity, or at any stage of advancement, short of the formation of an abscess, I should at once interdict nursing, friction, pumping, the application of fomentations, in fact every local measure excepting such as are calculated to secure complete rest for the gland; rest from passive motion, rest from secretion, and rest from pain. All these conditions can, in a great degree, be immediately secured for the patient. Procure at once a roll of soft cotton-wool, cotton batting, a plain roller bandage at least twenty yards long, and two, or two and a quarter inches wide, also eighteen large safety pins." The breast is first covered with a layer of cotton-wool, and the bandage so applied as to lift up and compress the affected organ. The patient should be seen daily, and the bandage reapplied until the crisis has passed; this time varying from one to several days.

If the inflammation should terminate by resolution it is quite probable that the secretion of milk will continue, and nursing can be readily resumed. So, too, lactation may continue after the formation of a small abscess, but if a considerable portion of the gland has been involved the organ will, in all probability, be rendered permanently useless.

[1] American Journal of Obstetrics, 1881. [2] Ibid., 1885.

CHAPTER III.

THE PATHOLOGY OF THE PUERPERAL STATE—(*Continued*)—PUERPERAL FEVER OR PUERPERAL SEPTICÆMIA.

PUERPERAL fever may be defined as an acute febrile affection, heterogenetic, contagious, and often epidemic, attacking women in childbed. The name, which dates from the beginning of the last century, has not escaped criticism,[1] and even its abandonment has been advised by some; but it is in such general use that it cannot be readily discarded. Nor is its disuse advisable unless one is led by it to regard the disorder as essential like typhoid fever with a definite course and uniform pathology.

Three propositions in the definition require exposition. First. The disease is contagious. The poison which causes it may be carried by the physician or nurse from a sick to a healthy puerpera. This doctrine is now generally accepted by the profession, yet many physicians in this country can remember the oral and printed words of great American obstetric teachers who denied it, inculcating with great power and with most mischievous results the opposite view. Dr. Oliver Wendell Holmes in a paper entitled Puerperal Fever as a Private Pestilence, published in 1843, and republished in 1855, probably did more than any other American physician to correct this erroneous teaching and to convince the American profession of the contagiousness of childbed fever.[2] Many an American mother owes her life to the striking array of facts he so clearly presented in sustaining his thesis; the number saved would have been still greater if his essay had been presented to every medical graduate before engaging in practice. Among the rules Dr. Holmes suggested were the following:—

[1] Pajot has said that the designation puerperal fever should be consigned to the museum of the antiques. Hervieux declares that there is no puerperal fever in the sense ordinarily attached to the word. "The admission of this seductive and convenient hypothesis is chaos, it is return to the infancy of the art, it is the negation of all diagnostic science, the obstacle to all progress in therapeutics in puerperal maladies."

[2] In Dr. Holmes's essay when republished some additions were made, and in these, referring to the criticisms made by a Philadelphia teacher of obstetrics, he thus speaks: "One unpalatable expression, I suppose the laws of construction oblige me to appropriate to myself as my reward for a certain amount of labor bestowed on the investigation of a very important question of evidence, and a statement of my own practical conclusions. I take no offence and attempt no retort. No man makes a quarrel with me over the counterpane that covers a mother with her new-born infant at her breast. There is no epithet in the vocabulary of slight and sarcasm that can reach my personal sensibilities in such a controversy. Only just so far as a disrespectful phrase may turn the student aside from the examination of the evidence, by discrediting or dishonoring the witness, does it call for any word of notice."

"1. A physician holding himself in readiness to attend cases of midwifery should never take any active part in the post-mortem examination of cases of puerperal fever.

"2. If a physician is present at such autopsies, he should use thorough ablution, change every article of dress, and allow twenty-four hours or more to elapse before attending to any case of midwifery. It may be well to extend the same caution to cases of simple peritonitis.

"3. Similar precautions should be taken after the autopsy or surgical treatment of cases of erysipelas, if the physician is obliged to unite such offices with his obstetrical duties which is in the highest degree inexpedient."

But it is not alone from post-mortem examination made of those who died from puerperal fever or of peritonitis, nor from the living who are suffering from the former disease or with erysipelas the contagion may be carried to the puerpera. In 1847 Semmelweiss, a native of Hungary, and assistant physician at one of the Vienna maternities, having charge of two cliniques, one devoted to the instruction of midwives, and the other to that of medical students, was struck with the great prevalence of puerperal fever in the latter, and its comparative absence in the former, and attributed it to the fact that the medical students were engaged in dissections and in post-mortem examinations and thence conveyed the poison from which the disease developed to women in labor or recently delivered. He required these students to use thorough disinfection before entering the obstetric wards, and the mortality of puerperal women, hitherto fifteen per cent., became less even than in those devoted to the instruction of midwives. He, too, thus became a savior of women, and his name deserves to be held in perpetual honor by the medical profession.

In a biographical sketch of Semmelweiss by Dr Herdegen,[1] the following incident is related: "A martyr to the new doctrine was found in Michaelis, the professor of obstetrics at the University of Kiel, and one of the first obstetricians of all time, whose work on the 'Contracted Pelvis' is now considered classical, all our modern views on the mechanism of labor being founded upon it. A near relation of his, whom he had attended in labor, died of puerperal fever. Convinced of the correctness of Sammelweiss's idea, and certain that it was he who brought her death instead of help, being at the time much occupied with autopsies on patients dead of puerperal fever, he laid himself on the railway track and was crushed by the train."

Another important fact in the etiology of puerperal fever was observed by the Vienna obstetrician. A pregnant woman suffering from advanced uterine cancer was in the ward. The precaution which had been for some time used, washing the hands in a solution of chloride of lime before making a digital examination, was neglected. The labor was prolonged for several days. As the case was very grave and rare, the students were eager to examine. Fourteen women who were delivered in the interval, and who consequently had been

[1] American Journal of Obstetrics, 1885.

"touched" by the pupils, had puerperal fever and died. With the exception of these unfortunate women there were no others sick.

Siredey mentions seeing two women die from septicæmia who were delivered in the house of a sage-femme who had living with her her mother suffering from uterine cancer; the midwife gave her mother vaginal injections, and the other attentions her state required, at the same time continuing her obstetric work.

The instances are many where hospital surgeons or physicians in general practice, going from patients with suppurating wounds to women in confinement, have carried fatal infection.

Charpentier mentions the following case, where the poison was communicated several days after labor: The wife of a physician, the seventeenth day after labor, was convalescing, when her husband, who had just returned from visiting a patient with diffuse phlegmon of the thigh, had the unfortunate thought of examining her to learn whether the uterus had returned to its normal state. The following day she had a violent chill, followed by all the phenomena characteristic of a purulent affection, and died the thirty-third day after labor.

Local disease of the practitioner has, in some instances, been the source of the poison. Siredey relates the history of a physician who, in consequence of a suppurating adenoma of his neck, had introduced a rubber-tube as a seton; previous to this he had attended eight hundred cases of labor without an accident, and now three women whom he delivered within three weeks were attacked with puerperal fever. He discontinued obstetric practice until the suppuration ceased. But the most striking illustration was given by a Philadelphia physician several years ago, Dr. David Rutter. He had nearly seventy cases of puerperal fever occurring within less than twelve months, while no instance of the disease was observed in the patients of any other accoucheur practising in the same district. Harris[1] states that Dr. Rutter had ozæna, which in time much disfigured him from its effect upon the contour of his nose. He was unfortunately inoculated upon his index finger from a patient, and neglected the pustule. He had ninety-five cases of puerperal septicæmia in four years and nine months, with eighteen deaths. Siredey, in referring to the etiology of the puerperal fever which so frequently occurred in this physician's practice that he was indeed "a walking pestilence," says that the explanation suggested by Harris was true, for Heiberg has discovered septic bacteria in the muco-pus of an analogous case.

In lying-in hospitals the contagion may be communicated by using the same sponges, basins, syringes, bed-clothing, beds, etc., for patients. As Siredey says one does not know how long disease germs sleep in these different objects, preserving all their injurious power up to the moment when they meet with favorable circumstances to reveal their power and claim new victims. Tarnier has examined the dust obtained by beating mattresses used by lying-in women, and the quantity of microbes found was immense.

It is probable, too, that the poison may come from defective

[1] Note to Playfair.

sewerage, from decomposing animal excreta, and from at least the malignant forms of scarlet fever or diphtheria, though in these cases the most rational hypothesis is not that diphtheria or scarlatina germs produce puerperal septicæmia, but that the poison of the latter is associated with that of the former. Nevertheless this is hypothetical.

"Some authors, among others, Atthill, assert that the poisons of some zymotic diseases, as scarlatina, typhus, typhoid fevers, etc., become so changed by the conditions of the puerperal state as to produce puerperal fever. This assertion has often been made, but is not supported by any convincing observations. Neither have any cases of scarlatina, typhus, or typhoid fever produced by puerperal fever been observed."[1]

The second proposition, contained in the definition which needs exposition, is that the disease is heterogenetic. Some authorities have not been satisfied with one puerperal fever, but insist upon several, each having a different etiology. In most cases, probably nine out of ten, of the disease careful examination soon traces it to an external cause, so that all will admit it to be heterogenetic. But again other cases occur for which no external cause is discovered, and therefore the hypothesis of self-infection or autogenesis is proposed. We do not thus reason as to other contagious diseases when we are unable, as we often are, to discover the source of the contagion. For example, in many cases of scarlet fever we cannot tell whence the disease came, but we never say it was generated in the patient that suffers from it. The doctrine of autogenesis is a confession of ignorance, the creed of fatalism, the cry of despair. It is more rational when we meet with cases of puerperal septicæmia whose origin we do not know, but which have the same history as others, the source of which we can trace to an external cause, and which have the same evolution and the same infecting power, to conclude that they too come from like sources, though the connecting thread is so fine that it eludes our vision, than to erect an altar to the unknown god of autogenesis, and imagine that we have explained the mystery. Self-infection means that the house sets itself on fire, and that the powder magazine is exploded without any mischievous spark. What security can the practitioner give his patient when the foe which brings swift death is created within her, and when she kills herself? This doctrine of the autogenesis of puerperal septicæmia is, to my mind, the very pessimism of obstetric medicine. Why should the city guard its gates when the enemy can already be in the citadel and begin the battle there? Two of the most recent authorities upon puerperal diseases have very positively given their opinion in regard to the question of autogenesis and heterogenesis. Siredey says, "I do not believe in gravidic auto-infection, and my opinion is that septic puerperal maladies are due to hetero-infection." Fritsch is still more positive: "To admit the existence of a spontaneous infection is to take a long step backward."

The third definition restricts the disease to the puerpera, and therefore excludes those reported cases where a similar infection was mani-

[1] Kucher, op. cit.

fested in pregnancy, those in which the infant was born affected by the disease, and finally those where non-pregnant women who from nursing patients with puerperal septicæmia became infected.

History and Theories.—Three hundred and thirty-two years before the Christian era Hippocrates attributed the chief diseases of women in childbed to suppression of the lochia, and this hypothesis was for many centuries accepted by the profession. Galen, more than five hundred years later, described inflammation of the womb as caused by lochial suppression. The opinions of these great masters held undisputed sway for many centuries. We find Sydenham in the period from 1675 to 1680 teaching that sometimes women from suppression of the lochia "fall into a fever, which either turns to that which is epidemical, or depends only on that beginning;" he recommended means to restore the flow, stating that if they failed the physician should "wait and see what time will do, for every day the business of the cure is more removed from danger, and if the patient live beyond the twentieth day she is in a manner beyond danger." In his chapter entitled *De Suppressione Lochiorum* he gives a brief but excellent description of puerperal fever.

The seventeenth century witnessed the proposal of a new theory, that which made the diseases of childbed dependent upon the milk. Hervieux states that the first traces of this doctrine are found in Sennert, 1631. He regarded in certain cases the acute fevers of women in childbed as depending upon derangements of the milk secretion. Primerose, 1655, also considered too great abundance of milk as among the causes of disease in puerperæ. But the name most intimately identified with this doctrine was that of Puzos, 1686. He held that milk formed from the food in pregnant and newly-delivered women circulated in a confused mass with the blood through all the body. During pregnancy the milk was most strongly drawn to the uterus by the infant, being necessary for its nourishment, but it sometimes happened that the infant could not use it all, and therefore the excess escaped by the vagina, by the breasts, or in the urine, and in the feces and the perspiration. It did not, however, always escape, but it became clotted from meeting with an acid in the blood, and milk deposits took place in different parts of the body. For more than a century the milk theory occupied an important place in explaining the etiology of puerperal diseases. Kirkland, in 1774, in enumerating the causes of childbed fevers mentioned as one the absorption of acrid milk.

The next doctrines as to the disease were those which attributed it to inflammation of different parts of organs in the abdomen; for some it was simply inflammation of the omentum, for others of the intestines, of the peritoneum, of the uterus and its appendages, of the uterus and peritoneum, in other words it was a metro-peritonitis, and some held it to be an angioleucitis, and others a phlebitis.

The view that next prevailed was that the disease was a putrid fever; Willis refers to it as such, and Charles White, of Manchester, stated that a true puerperal fever is originally caused by a putrid atmosphere.

The doctrine that it was an essential fever was ably maintained by

Dubois, and the following are among the arguments he used to sustain this view:—

First. The disease is not concentrated in the uterine system, but attacks organs remote from, and having no connection with the uterus; it involves important serous membranes—the pleura and the pericardium—the synovial articulations, and the cellular tissue of members, or of great splanchnic cavities.

Second. It is characterized by a general tendency to suppuration in different tissues, by a sort of purulent diathesis.

Third. Very probably it is sometimes propagated by contagion, but a simple phlegmasia is not contagious.

Fourth. The fact that it sometimes occurs as an epidemic with increasing gravity, indicates that there is but one general cause, unknown but real.

Very few physicians to-day believe that puerperal fever is an essential fever; Hervieux speaks of the theory as an unfortunate one, and the appellation as superannuated. In this country, however, it has been ably upheld by Dr. Fordyce Barker, who expresses his faith in the following propositions:—

1. There is a fever which is peculiar to puerperal women, and is, therefore, appropriately named puerperal fever.

2. The symptoms of this disease are essential and are not the consequence of any local lesions, and it is as much a distinct disease as typhus fever, typhoid fever, or relapsing fever.

3. It belongs to the class of zymotic diseases, and results from some unknown blood-changes.

4. We are as ignorant of the specific cause of these blood-changes as we are of those which develop relapsing fever, scarlet fever, or any of the other essential fevers.

5. The determining cause of this fever may be either epidemic influence, contagion, infection, or, probably, nosocomial malaria.

Three other propositions follow these, but those which have been quoted are the essential ones as presenting Dr. Barker's views in regard to puerperal fever. It was just to the most distinguished living American obstetric writer and teacher that such presentation should be made; nevertheless these opinions are not generally accepted to-day—indeed, Fritsch ungraciously speaks of them as antediluvian.

When Semmelweiss traced puerperal fever to the conveyance of decomposing animal matter to the genital organs of the puerpera he shed a new light both upon the etiology and the prophylaxis of the disease.

It must be remembered, however, that he taught the doctrine of auto-infection also, a view which was held by Spiegelberg[1] too, as

[1] Elsewhere, however, in the article upon Die Wundkrankheiten, das Puerperalfieber, he remarks in referring to the infection: "Probably, however, in many cases in which we regard it as having been first formed in the matter which flows from the wound, it has really entered from without; perhaps brought into the genital canal in minute quantity it finds in the lochia and especially in the putrid remains of tissue an excellent nourishing liquid, increases or grows in it, and infects from this on." Even in speaking of cases of "so-called self-infection," he refers to them as those in which the bacteria of putrefaction find the source in which

the following extract shows. The latter thus speaks of the important doctrine of Semmelweiss:—

"Semmelweiss was the first to announce that every case of puerperal fever was to be regarded as a resorption fever, caused by absorbing a decomposing animal matter brought in contact with the patient from the exterior, or developed in her own body, self-infection. These principles essentially are current at the present time; they contain in general all that can be said as to the origin of puerperal fever. And as the absortion can only occur at an injured surface, a wound, puerperal fever is classed among common wound-fevers, as far as this idea comprises all phenomena which occur in the entire organism as the result of local wound inflammation, local influence, that is, absorption of septic matter. Hence puerperal fevers are wound diseases, the puerperal fever is a septic poisoning in the most general or broadest sense of the word septic. Unfortunately this doctrine of the origin and extension of the puerperal fever is not accepted by all obstetricians. Even now it is assailed by many, especially by those living in other countries than Germany. Above all, its consequences have not yet been recognized as they ought to be, and many a life which could be saved is sacrificed to their neglect."[1]

But the question is unsettled as to what the poison is, some claiming that microbes are the essential agents, and Pasteur and his disciples "have erected the parasitic theory upon the ruins of the superannuated doctrine of essentiality;" others deny the agency of bacteria, asserting that while these are found in some cases of the disease they are absent in others, or again, that they may be present without the woman suffering from any pathological manifestations. The following is given by Dr. Jaggard[2] as the view of Karl Braun: "The significance of

they are developed in the individual, and adds it must be remembered the germ really came from without. Now this last statement is all that those who claim puerperal fever is not autogenetic assert.

[1] In connection with Spiegelberg's statement in regard to the non-acceptance of the contagiousness of childbed fever, the following is of interest:—

Stoltz states that he is not a convinced contagionist, and that he has never observed anything which would confirm his belief in contagion. He then uses the following language: "Never during more than forty-five years of hospital and civil practice, meeting with many epidemics, having had occasion to make more than a hundred autopsies of women who died of puerperal fever, autopsies which were usually performed in the morning after visiting patients, and whence I immediately went to visit women in childbed even without changing my clothes, never have I seen one taken ill in consequence of probable contagion, and then too, I was called in consultation with *confrères* who did no hospital practice and did not frequent amphitheatres. If I believe in the possibility of contagion, it is more theoretically than from experience, and because qualified *confrères* have such faith." (Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques, tome xxx., article Puerpéralité.) In the same article Stoltz relates the history of a primipara who was delivered by him with forceps, and the fifth day of childbed was attacked with violent peritonitis which proved fatal. This woman whose health had been perfect, left Paris a month before her labor, because there were several deaths of primiparæ from puerperal fever, and there was a panic among young wives of society in that city, and came to Strasbourg for her confinement. He states that he has always thought that this young wife brought the germ of her disease from Paris, for there were no cases in the former city, a consoling thought for one who had such little regard for disinfection that he went directly from autopsies of puerperal peritonitis to visit women in childbed without changing his clothes, and if he then went from autopsies of puerperal fever with still greater reason he did so from other autopsies. The hypothesis that this patient was infected in Strasbourg during or after her labor is more probable than that the infection occurred in Paris when there was no wound for its entrance, and that it slumbered for a month.

[2] The Pathology, Etiology, Prophylaxis, and Treatment of Puerperal Fever from the Vienna Standpoint. By W. W. Jaggard, M.D., Medical News, April, 1884.

bacteria in the etiology of surgical and puerperal fever seems to be a subordinate one; they seem to have no influence upon the origin, and perhaps no important influence upon the course of surgical fever. The putrid poison kills and produces fever with or without bacteria."

Independently of all culture experiments and inoculations, and microscopic examination of uterine and vaginal discharges of sick women in childbed, and of fluids or solids of women dying of puerperal septicæmia, there are some reasons which make it very probable the infectious agent is living, a *contagium animatum*, rather than any chemical substance, whether sepsis or ptomaine. These are the very minute quantity which infects, the rapidity of its action, and finally the protective power of germicidal solutions. It is only upon the hypothesis of a living poison with the great rapidity of reproduction which low forms of life have, that we can readily explain the fact of dangerous illness being so soon developed. And again, if we cure by using injections of corrosive sublimate or of carbolic acid in solution it seems more rational to conclude that the agent has destroyed living rather than rendered dead matter harmless. Moreover, the demonstrated dependence of many other diseases upon germs makes it probable that this also has a similar cause.[1] According to Pasteur and Doléris,[2] two kinds of organisms may produce infection: 1. The septic cylindrical bacterium, which causes rapid septicæmia. 2. The micrococcus in the form of a point which is inoffensive; in a second form two of these are united, this form causes suppuration; finally, the third degree or chain-like micrococci, *la forme en chapelet de grains*, which determines an attenuated septicæmia. A great fact according to them denominates puerperal pathological anatomy, it is the constant correlation of the presence of microbes with a determined pathological manifestation.

During the first four months of 1884, when there were under my charge at the Philadelphia Hospital seventeen cases of puerperal septicæmia, Dr. E. O. Shakespeare, the pathologist of the hospital, examined the lochial discharges of several of the women, and the general results are given in the following note:—

The examinations I have had the opportunity to make, although not extensive, appear in the main to confirm the opinion of Doléris as to the association of swarms of certain bacterial forms and the occurrence of fever.

As a rule, I have noticed both in those cases apparently progressing normally at the time of examination of the lochia, but which subsequently developed fever, and in those cases which, early after parturition and at the time of examination, were the subjects of febrile disturbance, that certain forms of bacteria were present in great numbers, viz:—

Swarms of micrococci in zoöglœcia masses; immense numbers of diplococci; chaplets of micrococci in strings of from four to eight; and rods of a peculiar form.

Whether these bacteria have aught to do with the production of puer-

[1] Even some who are not willing to admit the dependence of puerperal fever upon microbes, acknowledge that the doctrine has greatly contributed to the prophylaxis of the disease.

[2] Charpentier.

peral fever, or can be invariably relied upon as a sign of impending danger, my observations are as yet too limited to determine.

The microbes which are most constantly found in puerperal fever are chain-like micrococci, and in cases of the disease where these were not discovered it is possible they were still present, but methods of examination failed. Similar micrococci have been found in erysipelas, scarlatina, and in diphtheria, but similarity does not prove identity, and it may be that careful culture experiments will show that which the microscope has failed to do, an essential difference in these cocci. We must remember that microbiology is still in its infancy, and the relation of micro-organisms to diseases only beginning to be demonstrated, and therefore willing to admit that the chain of evidence is not yet complete which connects puerperal fever with the action of micro-organisms. Conceding this origin of the disease are there different microbes for the different varieties of the disease? Or do differences arise from the quantity introduced, and the receptivity of the subject, and the time of introduction? A plant does not thrive equally well upon different soils, nor seeds germinate with equal rapidity in all seasons, and why not admit similar results in microbienne maladies? Scarlet fever, in different epidemics and in different subjects, presents grades of intensity and degrees of danger widely separate, yet the poison is one, the disease is one. The origin of an epidemic of puerperal fever may be in a case of retained placenta where manual means have been employed to remove the placenta, these means failing to make the delivery complete; in a day or two the lochia become offensive, the woman has a chill followed by high temperature and increase in the frequency of the pulse. Other women are infected from this patient with different forms of puerperal fever, scarcely two presenting the same symptoms. Here there is a common cause, but various results; one fountain, but many streams.

But what role to retained clots, or as in the instance just alluded to, do fragments of placenta play in the genesis of the disease? Are they innocent, so that it is a matter of indifference whether they remain in the puerperal uterus? No, for while they do not create the disease, they furnish a nidus in which septic germs enter, a favorable soil for their development and multiplication.

As statistics prove that primiparæ, especially if old, are more liable to septicæmia than multiparæ, and also that there is a slightly greater liability after the birth of male than after that of female children, we readily see not the influence of protracted labor in itself, but of labors that are attended with more numerous or severe traumatisms; labors, too, in which a greater number of examinations are made, and which are more frequently terminated by artificial means. Now, these are the very conditions most favorable for infection. That the disease is more prevalent in the cold than in the warm months admits of a ready explanation, so far as maternities are concerned, in the fact that they are then more crowded, and that the rules of hygiene, especially as it relates to cleanliness, cannot be so well observed. Cold weather, too, often prevents thorough ventilation. Spiegelberg has suggested that

most of the blame is to be attributed to the dread the assistants have of washing their hands sufficiently often.

Clarke (1793) regarded the "previously distressed state of mind of females as probably disposing them to the disease." The same view has been expressed by many other writers.[1] In so far as physical or moral distress weakens the body and diminishes vital resistance, it is possible that they may add somewhat to the liability, but how often, on the other hand, have the robust and happy fallen victims!

Summary.—From what is known of so-called puerperal fever it should not be regarded as a specific disease, and strictly speaking there is no puerperal fever, that which is so denominated being a febrile affection caused by the entrance into the system of a poison from without, the nature of which we do not know, the entrance taking place through a wound of the uterus, or of some part of the vulvo-vaginal canal.

Pathological Anatomy.—This description of the post-mortem appearances is derived chiefly from the results of Siredey and Mayor's studies, and to this abstract will be added the reports of examinations made in some of my own cases.

Metritis.—The appearances presented in superficial and deep endometritis, and then those of parenchymatous metritis, will be presented. In benign cases the mucous membrane alone is altered; it presents a richer vascularization, is red, swelled, and somewhat friable, and covered with a red mucus. But other cases present more positive lesions. The internal surface of the uterus may be found yellowish or brownish, infiltrated, œdematous, and covered with pus having an offensive odor. There may also be upon it false membranes infiltrated with pus, more or less thick and adherent to it. They are formed by the mucous membrane in a process of necrobiosis infiltrated with pus globules and fat granules. These membranes literally swarm with bacteria. Léopold and Cornil state that this transformation of the mucous membrane into a mass of granulations, of leucocytes, and bacteria, coincides with a granular degeneration of the muscular fibres of the uterus. Mayor has seen the same lesions, and besides has found at the internal surface of the uterus, a true fibrinous exudate of a uniform rose color, which penetrated deeply into the thickness of the muscular tissue. Siredey, after describing the usual appearance of the inner surface of the uterus calls it diphtheritic endometritis. It is of interest and importance to quote in this connection the statements of Spiegelberg, first, as to diphtheria of ulcerated surfaces, "puerperal ulcers," found at the vaginal entrance, then of diphtheria of the uterus. "The coating usually called diphtheritic has no connection with diphtheria (Birch-Hirschfeld); it is composed of fibrin, and a granular mass

1 I have the notes of Prof. Wm. Shippen's Lectures on Midwifery, taken by Dr. Reading Beatty in Philadelphia more than a century ago, one of the surgeons in the Revolutionary War. Dr. Shippen not only taught midwifery, completing the subject in sixteen lectures, but also anatomy and surgery, occupying, as Dr. Holmes would say, not a chair, but a whole settee. He evidently held to the theory of lochial suppression as the cause of puerperal fever, for he described it by the name of lochial fevers, and said that they resulted from "violent affections of the mind, drinking spirituous liquors, and obstructed perspiration."

which originated in the disintegration of the superficial tissue layer of the wound, and pus corpuscles; it is an accompanying phenomenon of the regenerative process occurring in suppuration. If the case progresses favorably the healing goes on, the coating, through disintegration and the granulations rising beneath it, will be thrown off." He also states that in endocolpitis the injured surfaces are coated and discolored. In speaking of diphtheritic endometritis, the deposit being most frequent at the placental site, he remarks that this diphtheritic process has been considered by some, especially by A. Martin, as the essential element of puerperal fever; that it has been identified with true diphtheria, and as the first local effect of the infection from which the general condition followed. "But this was a mistake. The coating in question, as has been previously stated, consists of a so-called pyogenic membrane, formed on ulcerating surfaces by the condensation of products of inflammation."

Putrescent endometritis is not regarded by authors as of inflammatory nature. Desormeaux and Danyau have described it as gangrenous metritis. The mucous membrane is destroyed to a greater or less extent, and the muscular tissue left bare; the latter is brownish or greenish-gray, bathed in an infectious sero-purulent liquid, is softened, easily torn, and in parts thinned by ulceration, so that it is easily perforated. In some cases the external muscular layers of the uterus are affected with inflammation, but this is associated with lymphangitis.

Salpingitis and Ovaritis.—It is exceptional to find inflammation of the uterus without the ovary and tube being affected. Gordon (1795), in his treatise on the puerperal fever, makes the following remarks as to disease of the ovary:—

> In all the subjects which I dissected, the right ovarium was diseased, and the left sound. Now, it may be asked, was this accidental, or was there some other reason for it? I observed this in all the three cases, that ovarium was affected in which impregnation had taken place. Does the disease universally fix upon that ovarium in which conception had taken place, or is the right ovarium more commonly affected than the left, from some cause not yet discovered? I would therefore recommend this matter to the observation of future dissectors.

Puerperal salpingitis is characterized by a swelling of the tube which is sinuous and bosselated, presents an external surface reddish violet and a greatly increased vascularization. The fimbriæ of the swelled pavilion are usually congested, bright red, and covered with pus; at other times, however, they are marked by grayish lines indicating purulent infiltration. Upon opening the tube its lining folds are found red, very vascular, swelled and bathed with a liquid which is sometimes simply a mucus slightly opaque or cloudy, containing especially the débris of epithelial cells; but sometimes reddish and sanguinolent, and at others it is pus, or an infectious sanies with false membranes when the uterus is affected by a diphtheritic or putrescent condition. Usually the tube is pervious through all its extent, but it may be obliterated simultaneously at both the uterine and the abdominal end, so that liquid accumulates between, and thus an abscess may be formed,

which has the common termination of pelvic abscesses; in some instances the contents being sero-mucus there is dropsy of the tube or hydrosalpingitis. Sometimes the ovary seems scarcely altered at the surface; it is more or less swelled, and contains one or several cavities filled with pus; these are instances of phlebitis without any involvement of the peritoneum. In another series, on the contrary, there is peritonitis with lymphangitis. The ovary is somewhat swelled, its surface is sometimes smooth and scarcely altered, but again it is red, vascularized, and tomentous, and in some instances may be so irregular that it seems to have undergone a loss of molecular substance. Upon section it is soft and friable, and has been compared by Behier to a hepatized lung. It contains more or less clearly defined small hemorrhages, and the ovisacs seem increased in size, but the latter condition should not be regarded as pathological. The ovary may contain pus either simply infiltrated in its tissues or collected in the ovisacs, or in the stroma. Finally in some cases of grave puerperal septicæmia there may be found a cavity circumscribed by false membranes in which the débris of the ovary more or less easily distinguished are found floating in the midst of a brownish and fetid fluid; this condition has been described by Klob as putrescence of the ovary.

Peritonitis.—Women who die from puerperal peritonitis have great swelling of the abdomen, and when the latter is opened the intestines are found distended with gas, pushing up the diaphragm and hence the diminution of the thoracic capacity and the dyspnœa which preceded death. The peritoneum has lost its shining and polished appearance, and is the seat of fine granulations or of false membranes, and the surface is bathed with a more or less abundant sero-purulent fluid. The inflammation does not show the same intensity at all parts of the cavity, but is greater upon the organs of the true pelvis, the uterus especially, than upon the viscera in the upper portion of the abdomen. The liquid is more abundant than in other forms of peritonitis, and is yellowish, and, from the great quantity of pus-globules it contains, milk-like in appearance; this appearance led Puzos and his followers to attribute the disease to metastasis of milk into the peritoneal cavity. The extension of inflammation to the diaphragm explains the frequent coincidence of pleurisy with peritonitis, not only by the quasi-contiguity of the two serous membranes, but by the continuity of the subpleural lymphatics.

Uterine Lymphangitis.—In examining the uterus there will be found at its surface, especially at the posterior face and the borders, white, yellowish, and nodulated corns, with irregularly distributed interruptions. Their volume is variable, in one place so small as scarcely to equal that of a sewing needle, in another the size of a surgeon's probe; at other points there are enlargements differing in size from a hemp-seed to a bean. The lymphatics are then easily recognized by the naked eye. Sometimes they are masked by a thin layer of peritonitic exudation, or, in other words, false membrane, which must be removed in order to find beneath them the inflamed lymphatics. Champonnière justly insists upon the fact that these membranous exudations are situated precisely at the level of the lymphatics, so that through them the

extension of the inflammation to the serous membrane occurs. Section of the uterus makes still more evident the affection of the lymphatics if an incision is carried through the muscular tissue, especially when thin slices are made at the insertion of the appendages and the broad ligaments; pus oozes from the gaping orifices of the divided vessels, and by pressure there is caused a flow of yellowish, creamy, and homogeneous liquid. Posteriorly at the level of the union of the body and neck of the uterus there is a ganglion described by Champonnière, which is often inflamed. Also in the middle of the rich vascular plexus of the broad ligament there are found in the lymphatic network small rose colored tumors which are inflamed and hypertrophied lymphatic ganglia. The lymphatic vessels connected with the iliac and lumbar ganglia are greatly enlarged, some of them being the size of a crow-quill.

The nodosities of the inflamed lymphatics correspond to the intervalvular spaces, which are distended with pus. These apparently purulent sacs are found in all parts of the uterus, but they are especially abundant at the union of the neck and the body; in some instances pus is found only in these, a fact which is readily explained when we remember the frequency of contusions and tears of the neck.

Siredey states that "there are cases in which lymphangitis occurs without the participation of the uterus, but the disease is present at the surface of the ovary, especially at its hilum, or at the pavilion of the tube. Now with uterine lymphangitis peritonitis is almost constantly found, and it has its origin most frequently at those parts where the lymphangitis is most decided, that is, in the vicinity of the appendages and the borders of the uterus. On the other hand, lymphangitis at the level of the union of the neck and the body, in the thickness of the broad ligaments, and in the vicinity of the lumbar or iliac ganglia, causes an infiltration of the connective tissue which is more manifest during life than after death. This œdema resisting the pressure of the finger, increasing the thickness of the broad ligament, is the indication of the inflammation in its first stage, which has its origin in the lymphatic system, and secondarily tends to invade the neighboring connective tissue, constituting that pathological condition until recently scarcely known, and which formerly was called phlegmon of the broad ligament, but which we to-day designate as adeno-phlegmon or phlegmonous lymphadenitis."

Adeno-phlegmon.—The first lesion of this pathological condition is a gelatinous thickening of the meshes of connective tissue, situated principally at the insertion of the broad ligament, forming a tumor the size of which varies from that of an almond to that of an egg, or it may be much larger, or instead of a tumor there may be simply an induration. Upon section the indurated part presents at its periphery a gelatinous, transparent aspect, but as the centre is approached the tissue becomes cloudy and opaque, while at the centre cream-like pus is found; the pus does not always occupy a single point, but is collected in several small cavities. Making many sections, inflamed lymphatic vessels are divided, and minute drops of milky, homogeneous pus ooze from the vessels; pus is not only found in the vessels and

in the ganglia, but also in the peri-vascular sheaths. The connective tissue is œdematous, its fibres swelled, and its cells large; the latter appear to be in process of multiplication, and have rounded forms; their protoplasm, at first turbid, is soon loaded with fat granules, then globules of pus are formed. But, beside, a homogeneous or slightly granular matter is effused between the formed elements of the connective tissue, an inflammatory exudate, which covers and encircles the degenerated cells; hence the gelatinous appearance presented to the naked eye. Such is the character of an adeno-phlegmon at the beginning.

When the pus is collected and contained in a fibrous sac, the lining of this is a true pyogenic membrane. Abscesses which do not attain a considerable size may be absorbed. More frequently, however, the pus finds its way into a neighboring organ, as the bladder, the uterus, or the vagina, or the rectum, and sometimes extends far from its origin by separating the peritoneum. Most of the cases of phlegmon of the iliac fossa or of the broad ligament occurring in recently delivered women result from lymphadenitis.

In periphlebitis the pus is always scanty, and of a reddish color, like that of the lees of wine, while in lymphadenitis there are often large collections of creamy, whitish, and perfectly homogeneous pus. In exceptional cases the lesions of phlebitis and those of lymphangitis may occur together.

Lymphangitis rarely exists alone, its habitual if not constant complications are peritonitis and phlegmon of the broad ligament, or of the iliac fossa; and peritonitis almost necessarily accompanies uterine lymphangitis or adeno-phlegmon, the lymphangitis of the broad ligament, or of the iliac fossa.

Uterine Phlebitis.—Uterine phlebitis may occur alone, perfectly isolated, or be associated with lymphangitis. When the two are united, generally the symptoms of lymphangitis predominate during life, such as the grave accidents of peritonitis or adeno-phlegmon, and occupy all the attention of the physician. The lesions observed at the autopsy chiefly belong to the peritoneum and to the lymphatics; the phlebitis itself does not present distinctive characters. But in those cases of death from uterine phlebitis, one is struck upon first opening the abdomen by the absence of grave lesions; there are no false membranes, and no effusion of pus or of serum in the peritoneal cavity. Sometimes there are in the vicinity of the ovaries, or at the borders of the uterus peri-vascular abscesses, and these organs may be violet-colored or livid; but frequently no lesion can be distinguished upon a superficial examination. Siredey suggests that such cases have often furnished valuable arguments to sustain the theories of the essentialists.

The condition of the uterus varies with the time after delivery that death occurs; in general, this comes much later than in cases of lymphangitis, and hence uterine involution is farther advanced, but this is never complete, even if a fatal result has not occurred until several weeks after labor. The surface of the uterus is regular, and almost normal; but the lesions of the appendages are more decided. Sometimes there may be found in the substance of the broad ligaments flexuous,

irregular, bead-like cords passing toward the pelvic walls; generally the lesions are limited to two or three vascular trunks, and do not involve as in lymphangitis an entire network of vessels. Very often during life there may be disturbances of circulation in the lower limbs, and at the most dependent parts of the abdominal wall; for example, a greater or less œdema at the groin, of the thigh, or of the entire member. If the uterus be incised from before back it is easy to distinguish in the vicinity of the placental insertion sinuses filled with pus; this pus is different from that found in lymphangitis; it is not white and cream-like, but a reddish, sanious, puriform liquid. In general, the pus of venous abscesses is mixed with blood clots, forming with them a thick, chocolate-colored compound. Sometimes the pus occupies a great extent of the vein, but in others there are interruptions caused by adherent clots.

As has been stated, the lesions are found more readily in the vicinity of the placental insertion, and hence are more frequent at the upper parts of the uterus; but there are also present in other parts of the uterine parenchyma veins filled with pus and reddish clots. These lesions, too, are found in the veins of the utero-ovarian plexus. Moreover, obstruction of the utero-ovarian veins is a constant pathological fact, while thrombosis of the uterine sinuses at the site of the placenta is a normal phenomenon, so that should one discover pus and a puriform mass at the latter place, it is difficult to affirm true lesions, and therefore the condition of the utero-ovarian veins ought to be regarded as typical. These vessels present a moniliform appearance; they are hard, resisting cords presenting here and there dilatations which are soft, and which are filled with the red, sanious matter previously described; the clots which the vessels contain are in some cases quite adherent, but in others the inner wall is apparently ulcerated, bleeding, and bathed with pus. The walls are very much thickened, and there is also inflammation of the connective tissue surrounding the vessels, so that the latter are fixed in place, and attached to neighboring organs.

Though these lesions are often limited to the uterus, not seldom they may be met with at different points of the pelvic cavity, and in many cases may be followed into the hypogastric veins, and beyond. Sometimes they are absent in the uterus, and are only found at the ovary or in the substance of the broad ligament.

In the further study of phlebitis it is necessary to consider it under two forms, the one simple or adhesive, the other infectious. 1. Simple phlebitis. This is the more frequent, the less grave, and has often been mistaken or falsely interpreted. In its typical form it is simply a thrombosis obstructing the lumen of a vessel; fibrinous clots thus rendering veins impervious are never followed by metastatic abscesses in the different viscera, and there is no formation of pus in the vessels. Upon opening an affected vein a firm clot is found more or less adherent to the inner wall, and extending to the entrance of an important collateral branch, where it may terminate; the end of the clot being conical, has been compared to the head of a serpent; or it may be prolonged beyond the first collateral branches, and invade the

larger trunks, and the branches situated higher up may in their turn become closed by thrombosis if they cannot empty through a collateral vessel. "Thus it is not rare to see a clot originate in the uterus, follow one of the veins of the utero-ovarian plexus, penetrate into the hypogastric, which in turn becomes affected, and extend into the primitive iliac. Thence the thrombosis gains the venous branches which are tributary to the primitive iliac, and especially the external iliac and the femoral, and thus we have explained the frequency of phlebitis of the lower limbs in lying-in women. A great number of cases of phlegmasia alba dolens in childbed are connected with secondary thrombosis propagated from the uterus." This affection does not occur until several days after delivery, and in almost every patient there is preceding evidence of pelvic inflammation, or some other manifestation of septic infection, and it should be regarded as one of the many and varied phenomena of septicæmia.

2. Infectious phlebitis. The infectious form differs especially from the adhesive by its consequences; its characteristic is the formation of septic products which enter the circulation and are distributed throughout the economy. It cannot be clearly distinguished from the adhesive form by the naked eye, for there are the same venous cords partially filled with fibrinous resisting clots, but the clot softens and its broken down material enters the circulation; suppuration too originates in either the clot or the walls of the vessel, and abscesses are formed. The walls of the veins are thickened, and in their external part very numerous embryonic cells separate the normal elements; in some cases small abscesses are found, and sometimes there is in a certain extent true ulceration, which may have gone so far as to destroy the walls of the vessel.

Whatever its origin—whether cause or consequence of phlebitis—the clot, formed of concentric layers which become paler as the centre of the vessel is approached, fills the vein, and in adhesive phlebitis the union of the former with the wall of the latter becomes stronger; the next step is the organization of the thrombus which takes place by the medium of new vessels which projecting from the walls of the vein penetrate it.

But in infectious phlebitis the course is different. The thrombus is soft, blackish, and does not completely obstruct the vein, and here and there are cavities filled with a puriform liquid; this liquid contains leucocytes which have undergone fatty degeneration, pigment masses derived from the deformed red globules and numerous parasitic organisms, which Doléris has shown are the same as those which are found in patients who after surgical operations suffer from pyemia. The disorganization of the clot probably is caused by the microbes, and the visceral manifestations of infectious phlebitis are thought to be due to the transportation of the micrococci into the different organs, these manifestations being infarctus, and multiple abscesses resulting from capillary embolism.

Having thus briefly presented the pathological anatomy of puerperal septicæmia as derived chiefly from the investigations of Siredey

and Mayor, there will next be given a brief history of three cases of the disease occurring under my charge at the Philadelphia Hospital, which were fatal, with the autopsies.

M. P., sixteen years old, unmarried, primipara. She was delivered on January 12th of a living female child weighing eight pounds, after a labor of nearly twenty-four hours; the presentation was pelvic. Her convalescence seemed to be uninterrupted until fourteen days after her labor, when she complained of pain in the abdomen and had some fever. The next day she was transferred to the fever ward; her pulse was then 120, and her temperature 102° F., the abdomen tender on pressure and somewhat tympanitic. The symptoms of peritonitis were well marked. No chill occurred at the beginning or in the course of the disease. In three days pleuritis was evident, and death took place on the first of February, the seventh day of illness, or the twentieth day of puerperality. The following were the post-mortem conditions as noted by Dr. Shakespeare, pathologist of the hospital:—

External Appearance.—Evidence of blister over epigastrium and lower aspect of each mamma. Shows abrasion of an area of about three inches square. Nothing else noticeable.

Thorax.—Very extensive pleuritic adhesions on both sides, consisting of recent, mainly dry lymph of a yellowish color. The same material also binds the lobes together. The thoracic cavity contains a considerable amount of serous fluid. The pericardial cavity also contains considerable fluid, and there are numerous minute ecchymoses on the parietal pericardium, especially near the origin of the large vessels, and extending along the anterior surface. The visceral pericardium, particularly on the anterior surface, shows similar ecchymoses.

The *heart* is of normal size, consistence, and color. The right ventricle partly occupied by a clot mainly chicken-fat in character, which toward the pulmonary orifice assumes a fibrous consistence, and extends far into the pulmonary vessels. The left ventricle is of normal size and contains a very small clot, fibrous in character, which does not extend beyond this cavity. The valves and ascending aorta normal.

The left *lung* is completely solidified, but not appreciably swollen. The cut surface appears smooth, semi-translucent, and not at all granular. In the lower lobe there are one or two wedge-shaped areas characterized by a difference in color from the surrounding tissue, and in them are slight appearances of granulation. They are mainly superficial and probably embolic in origin. No emboli are seen in the vessels comprised in the area, yet the vessels occupy the central portion of these areas. No such appearances of embolism are noticeable in the upper lobe. The right lung shows the two upper lobes normal in appearance, as also the lower lobe, except that the latter is slightly congested and contains little air. The bronchial glands of right side contain some points of cheesy and others of calcareous degeneration. These glands are not softened. The glands on the left side are considerably softened, but contain no caseous points.

The *abdomen* contains considerable serous fluid, with many large floating flocculi, yellowish in color. Adhesions are numerous between the coils of intestine, omentum, and abdominal walls, particularly marked over liver and pelvis. Adhesions are easily torn, consisting of recent unorganized lymph.

The *uterus* is about 5 inches in length, $3\frac{1}{2}$–4 in breadth, and 2 in thickness at the fundus. The external surface is covered with lymph, especially well-marked in the posterior cul-de-sac, and over the ovaries. No abnormal appearance is noticed in the walls of the uterus or in the lining of the uterine cavity.

The *liver* weighs $4\frac{1}{2}$ pounds, somewhat enlarged, surface smooth where there are no adhesions. It is of a deep red color, and the capsule of Glisson readily strips. The gall-bladder contains but little fluid, and this of a dark, grumous character. No calculi. The right lobe thickened from above downward to the extent of about four inches. Cut surface natural in color, dark red, and presents no visible abnormality. The substance, however, is easily mashed and torn by the finger, but the organ is not flabby.

The *spleen* is but little, if at all enlarged, and weighs six ounces. Surface normal. Organ somewhat flabby, the pulp is dark red in color and somewhat lessened in consistence. No other noteworthy appearance.

Substance of the *pancreas* normal.

Kidneys of normal size and appearance. The capsule readily strips, leaving a smooth surface. The substance of the organ firm and not visibly altered.

Cause of Death.—Puerperal (?) plastic inflammation of the serous cavities with left-sided pneumonia.

Here is a fatal septicæmia involving the great serous membranes which gave no indication of its presence until fourteen days after labor, and its advent was not marked by a chill. These facts are certainly remarkable. Dr. Shakespeare expressed the opinion that such extensive disease probably indicated a longer duration than the record showed. Another point of some interest in this case is that the temperature never rose higher than 103.8°, and that elevation occurred just before death.

The second fatal case was a colored woman, twenty-two years of age, the mother of four children. Her labor, occurring at term, lasted a little more than six hours. She was doing well until the third day, when, without any preceding chill, her temperature rose to 102° F. She became delirious the afternoon of that day, attempted to kill her child; jumped out of bed, running about the ward, and it was only after repeated doses of chloral that she was quieted. I saw her the next morning, when she was quite rational, but she still had fever; the lochial discharge was scanty and very offensive; the uterus was tender to the touch and larger than it should have been at the fourth day; by my direction she was removed to the fever ward. That evening her temperature was 105.6°; it gradually lessened until the day before her death, which occurred on the sixth of the disease, when it fell to 101°, but rose in the night to 106.2°. Her pulse varied between 120 and 150.

The post-mortem was made by Dr. Formad, and the report of it is as follows:—

Thorax.—No effusion in the pleura. Lungs highly congested and filled with œdematous fluid, discolored by decomposing coloring matter of the blood; otherwise natural. Pericardium contains some increase of fluid—

also discolored. Heart very much softened, congested, and muscular tissue friable, giving signs of acute atrophy; otherwise size and condition of organ normal.

Abdomen.—Signs of a recent peritonitis, but not of a purulent character, the serous membrane being only congested, and no exudate of any kind visible. The mesenteric glands are all enormously enlarged, and upon section show cheesy infarction, and to some extent purulent contents. The lymphatic glands are also enlarged, some of them reaching the size of a walnut.

Uterus.—This is the size of a child's head, and on section the muscular walls show a thickness of about one inch. The mucous membrane is in a state of acute inflammation accompanied by a gangrenous change. There appear to be some fragments of placenta with some necrotic change adherent to mucous membrane.

Ovaries.—These are normal.

Liver is in a state of acute yellow atrophy, being soft and friable. The parenchyma gives evidence of acute softening change. Gall-bladder filled with normal bile. Weight of liver two pounds six ounces. Spleen is completely disintegrated, being only a pulpy, semi-fluid mass, held together by the capsule. Kidneys completely softened by septic changes; otherwise normal in size. Rest of organs all softened, and give evidence of acute septic change. A good many of the changes must be attributed to post-mortem causes, the examination being made thirty hours after death, but the case is, nevertheless, undoubtedly one of septic poisoning, taking its point of departure from the gangrenous changes in the cavity of the uterus.

The third one was a patient to whom I have already referred in connection with the subject of rupture of the uterus. She was a multipara, twenty-four years of age. Her temperature, twenty-four hours after labor, was 100.8°, but the next morning it had fallen to 100.2°, rising, however, in the evening to 101°. Great irritability of the stomach began the second day after delivery, and continued with only slight occasional abatement; the third day she had a chill at 4 A. M., and the fourth day another one at 8 A. M., her temperature then rising to 104°. There was great tenderness when pressure was made upon the uterus and over the right broad ligament; the uterus was a little below the umbilicus, and the lochial discharge was very offensive; there was an entire absence of milk secretion. She had occasional attacks of diarrhœa; her face was pinched, anxious, generally bathed in perspiration, and had a leaden hue. On the sixth and seventh days also a chill occurred, and on the eighth she died. The fourth and fifth days of her illness her temperature was only 99°, but on the sixth it rose to 102.2°, and the morning of the day of her death it was a degree higher.

February 1, 1884. M. D., aged twenty-six, white, autopsy twenty-six hours after death.

External Appearance.—Considerable lividity and mottling of the skin of the dependent portions of the body, but not of the upper, it being blanched.

Thorax.—Pleural cavities normal. Pericardial cavity contains half an ounce of serous fluid. Pericardium normal.

Heart.—Some slight congestion of the small vessels at the root of the large cardiac vessels. Of normal size and normal external appearance, and of flabby consistence. The ventricles and auricles contain dark, clotted blood; no abnormality otherwise, except a small, somewhat tough fibrinous clot in the right ventricle.

Lungs.—Normal, except the lower lobes, which are much filled with hypostatic blood.

Abdomen.—Cavity contains a considerable amount of puriform fluid. Both the visceral and parietal peritoneum show general congestion, and some points are covered with lymph. In the iliac fossæ the adhesions of recent lymph are quite extensive. The purulent collection and lymph are quite marked in the pelvis.

Uterus.—Of flabby consistence, about six inches in length, four inches in breadth, and averaging an inch in thickness. On exposing the cavity, it is found that the mucous membrane and uterine wall at the cervix are extensively degenerated, of a dark gangrenous appearance, and on the left side there is a very extensive rupture, involving the whole length of cervix and lower portion of the body of the uterus.

Liver.—Pale, smooth surface, and flabby. Capsule of Glisson not abnormal, but the cut surface, notwithstanding its flabbiness, shows an increase of consistence. The finger is forced into it with some difficulty. Somewhat buff in color. The lobules are not distinctly marked. It weighs $2\frac{3}{4}$ pounds.

Spleen.—Pale in color, and weighs $4\frac{1}{2}$ ounces. Capsule smooth; pulp light colored and only slightly softened.

Kidneys.—Nothing abnormal.

Cause of Death.—Acute puerperal peritonitis, probably of septicæmic origin.

CHAPTER IV.

GENERAL DESCRIPTION OF PUERPERAL SEPTICÆMIA AND DESCRIPTION OF ITS VARIETIES—PROGNOSIS—SUDDEN DEATH—TREATMENT OF THE DISEASE.

It is necessary to consider puerperal septicæmia under two forms, benign and grave, and then follow this general description with that of the chief varieties

The benign form of puerperal fever does not usually begin until the third day, though it may somewhat later, or even sooner. In the majority of cases the development of the disease is announced by a chill; this chill may last for a few minutes, or for a quarter of an hour; in some cases it is only a "creeping" sensation of cold, but in others it is attended with shivering and chattering of the teeth; in a few instances it may be absent, nature failing to give this cry of alarm. Elevation of temperature follows, the mercury ascending to 104° F., or even higher, then declines to 102.5°, remaining at this with slight oscillations, and especially with an evening elevation, for a week or ten days. The milk secretion, if the disease begins before the third day, is often prevented, but if, after its establishment, it is diminished, or may cease altogether; some patients, however, are able to nurse their children during the entire sickness, though the supply of milk is scanty, but when they convalesce it is ample. The lochial discharge is lessened, sometimes temporarily arrested, and usually becomes offensive, if not already so before the chill. There is pain in the lower part of the abdomen, and it may be so severe that the patient cries out with it, or it prevents her rest; where pain is not spontaneous, it can in almost all instances be evoked by pressure upon one or the other side of the uterus; it is lessened, and often disappears, at least in its spontaneous manifestation, after the first few days. "Pain indicates the point of departure of the lesion. Its intensity measures its progress, and its seat is in correspondence with the extent of the inflammation."

One of the most marked characteristics of the disease is the arrest of uterine involution; the uterus not only fails to decrease in size, but in many cases it is less firm and larger. But there may be found in some instances, after two or three days, not a distinct tumor directly adjacent to it, but a swelling and resistance at that place where pain was most complained of, or where it was evoked by direct pressure. "The occurrence of this localized swelling is a favorable indication, for we thus know that the disease is limited, and loses its tendency to become general." The stomach is in many cases irritable, and nausea and vomiting occur; the bowels are usually constipated, and the urine free from albumen.

In the grave form of the disease, which is more frequently observed in epidemics, whether occurring in maternities or in private practice, these epidemics destroying frequently the majority of women in childbed, the chill usually occurs within the first forty-eight hours after labor. Fever follows, the abdomen at its lower portion is painful, often exquisitely sensitive, and somewhat swelled. The temperature is 104° or less, or it may be even 106°; morning remissions are slight or absent; the abdomen becomes distended with gas, chiefly probably in consequence of a sub-paralysis of the muscular coat of the intestine, and the thoracic cavity lessened by the pressure from below upon the diaphragm causes the respirations to be frequent, independently of the frequency dependent upon the febrile state, and shallow; moreover, deep inspiration is avoided, because it increases the abdominal suffering. The tongue is dry, the thirst excessive, and there is gastric irritability.

Harvieux makes the following important remarks as to the significance of this symptom: "The nausea and vomiting of the initial period, when they are not great, and when only drinks and food are expelled, and when they cease spontaneously, have little significance. But if manifested at a more advanced period of the disease and are bilious, they announce great danger. If the bile expelled, instead of being liquid and yellow, has a semi-solid consistence, is of a dark green, almost black, and if at the same time it comes in the mouth without effort, and is rejected by simple movement of regurgitation, it may be feared that the end is at hand. At the maternity a woman who *vomits green*, using an expression employed by the pupils, is a lost woman."

The urine is scanty, high-colored, and usually albuminous. The pulse is from 100 to 120, and toward the last may be 150 or more; its volume is lessened, and at first hard and quick; as the disease progresses it becomes weak, scarcely perceptible, a mere thrill or undulation, a tremulous flutter. The patient lies upon her back with the lower limbs flexed, and avoids all movement; the least pressure upon the abdomen causes suffering. The sudden disappearance of pain is a most unfavorable symptom, for it announces, as Gordon said, the approach of death.

Diarrhœa is not uncommon in the course of the disease; at first, the discharges are natural, except in consistence and in frequency, and then they become dark, watery, and most offensive in odor, are not easily checked by medicine, and often are involuntary. Sometimes the diarrhœa is so profuse, the rejection of food by vomiting so constant, and the pain so great that the patient sinks into a prostrate condition, somewhat resembling the collapse of cholera, or that seen in the form of malarial fever called by Wood pernicious, and which is well known to practitioners in the western and southern portions of our country. The features are sharp, the eyes clear and sunken, the skin covered with a viscid perspiration, the mind unobscured, and the desire for drinks so intense that she is consumed with this thirst.

In some cases towards the close of the disease the skin becomes discolored by jaundice, the discoloration being of a deep, rather than of a light hue. More frequently, as the end approaches, the face has a leaden

hue, from imperfect oxygenation of the blood; this approach is generally without marked clouding of the intellect, and the patient fully realizing her great peril, turns with imploring looks to her physician, and possibly with uttered words begs him to save her. A fatal result may occur within thirty-six hours, but oftener is delayed to some time between the fifth and the tenth day, comparatively rarely beyond the latter time.

Siredey describes a typhoid form of the affection, of which the following are among the chief characteristics:—

The skin, usually pale, presents upon the face, upon the dependent parts of the trunk and limbs red, violaceous patches, which disappear when pressed by the finger, and return when the pressure is removed. The pain observed in the first days of the disease lessens or even disappears; the abdomen remains meteorized; the lips are dry, the gums covered with sordes; the tongue, deprived of its epithelium, is cracked and parched; the diarrhœa is abundant, infectious, and often involuntary; the lochia are horribly fetid, and the genital parts are swelled, and sometimes present a phlegmonous appearance. The wounds or tears which the last present are the seat of ulcerations covered by a grayish diphtheroid coating, or there may be gangrenous patches that give no doubtful indication of the origin, the seat, and the infectious nature of the accidents.

It is in such cases that pleuro-pulmonary complications especially occur. It is not unusual to meet with cardiac disease, the most frequent lesion being ulcerative endocarditis, and vegetating endocarditis, with or without myocarditis. The liver and the spleen are increased in volume by congestion; albuminuria is present. In some cases there is a tranquil sub-delirium, at first occurring at night, and not becoming continuous or noisy until in the last stage of the disease.

But in addition to these more acute forms of septicæmia there is another which is not manifested until several days after delivery, and which is often protracted for many weeks. The patient's condition presents nothing to create anxiety for the first four or five days, or even for a week or longer time, and the attendant anticipates a favorable and prompt convalescence. This hope is suddenly dissipated by the occurrence of a chill followed by fever; but there is no abdominal pain or swelling, and frequently no abdominal tenderness even upon severe pressure; the lochial discharge may be quite normal or but slightly deranged, and the urine usually shows but a trace of albumen. The chill may be very slight, and rather a chilliness than a decided shivering, but high temperature follows, the mercury ascending to 104°, or even reaching a greater elevation. This stage is followed by a fall in the temperature, so that it is almost if not quite normal, and by perspiration. At this time the practitioner is liable to think the case one of malarial fever, and so treat it; it is natural for us to believe the things we desire to be true, and it certainly is much pleasanter for us to think we have a case of intermittent or of remittent fever than of septicæmia to treat. But we must remember that malarial fever in childbed is not frequent. In the last three years it has been my lot to see upwards of fifty cases of fever in women in childbed, and of the entire number

only two were malarial, the others being septicæmic. Returning to the description of the disease in question, the hope that the subsidence of the fever is premonitory of speedy recovery, because the treatment is so plain and certain, is disturbed or ended by the return of a chill, or of a chilliness, and the succeeding fever, in spite of the antiperiodic which may have been freely given. And thus day after day, week after week, the case may go on, no regularity being observed in the recurrence of the chills and in the elevations of the temperature; sometimes there are intervals of several hours or even of a day or more when the thermometer marks so little elevation that one thinks recovery is about to begin; but finally convalescence occurs without other accidents intervening. But, on the other hand, the patient may enter upon a typhoid state, the puerperal typhus of Cruveilhier, and present many of the symptoms observed in true typhoid fever; it is not necessary to refer to the dry tongue, the coated teeth, the stupor, the prostration, and possibly the occasional attacks of diarrhœa. The lochial discharge may be very offensive, but certainly in some cases this condition is only occasionally present, while in others it may be absent during the whole course of the disease. Mental disturbance is usually present in the form of slight wandering at night, or simply "talking in sleep;" but there may be also mild delirium when awake, and in all patients there is more or less dulness of intellect and apathy.

Purulent affections of the joints, abscesses in the connective tissue, of the limbs or trunk, or of internal viscera, occur in some cases; in others an adhesive phlebitis in the form of phlegmasia alba dolens is manifested, and this is to be counted a fortunate occurrence, for it shows a favorable degree of reaction, and furnishes a hope that no further manifestation will occur, but the disease be limited to the affected limb.

Having given this general description of puerperal fever in its chief forms, I will now present special varieties of the affection.

1. *Inflammation of the External Genital Organs and of the Vagina.*—The former of these affections is described by Siredey as lymphangitis, and the latter is known as endo-colpitis. Garrigues maintains that diphtheria occurs in some cases, and his views will hereafter be presented. The following illustrative cases are now given:—[1]

S. E., 21 years old, multipara, was delivered January 4th, 1885, of a healthy male child after a comparatively easy labor. Previous to labor there was observed a large chancroidal tumor upon the left labium majus, and some similar sores just within the vaginal entrance. The patient's temperature the next morning was 102.4°, no chill having preceded the fever. The labia were swelled and œdematous, the left labium majus being chiefly affected. There was no pain, tenderness, or swelling of the abdomen. Her temperature after its first elevation remained above 102° for a week, at one time being 104.8°. The lochial discharge was offensive, the urine contained no albumen. The treatment was daily

[1] These are taken from the report prepared for me by Dr. Daggett, one of the resident physicians of the Philadelphia Hospital, of twenty cases of septicæmia which occurred in the obstetric department of that institution in the winter of 1884–5, most of them being under my charge from the beginning.

injections of corrosive sublimate solution, 1 to 2000, the introduction into the vagina of an iodoform bacillus, and the internal administration of quinine and whiskey, and morphia when sleepless. On the ninth day as her condition was so much better, and her temperature normal, treatment was discontinued; but in the afternoon she had two chills within an interval of an hour, her temperature was nearly 103°, her pulse weak, her countenance pinched, and her prostration very great. The quinine and whiskey were resumed, and on the twelfth day convalescence was re-established, and progressed without interruption.

A. D., primipara, 18 years old, was delivered of a female child January 20, 1885. The second stage of labor was somewhat protracted by the resident physician holding back the head until the vulvo-vaginal orifice was sufficiently dilated to prevent rupture of the perineum, and the perineum was saved, but, as the sequel showed, at the expense of the serious injury to the vagina. The long-continued pressure of the head caused sloughing in the latter posteriorly, and associated with it there was great swelling of the right labium majus. She had no chill, but her temperature continued to rise progressively until on the fifth day it was 104.6°. There was some abdominal pain, but this was not great, and no tumor or tenderness was found by palpation; digital examination gave no evidence of any inflammation except that of the vagina. The lochial discharge was very offensive, and continued to be sanguineous a much longer time than normal. A month passed before she was convalescent, but during her sickness there were no chills; she nursed her child, although for a time the milk was scanty, but upon recovery the supply was abundant. The local and the constitutional treatment were the same as in the preceding cases, except that iodoform was used more freely, four or five applications being made daily.

In the majority of cases the injuries of the vulva received in childbirth heal within a few days, and very little constitutional disturbance results from them; the so-called milk-fever generally is caused by these lesions. One of the consequences of these injuries that is sometimes observed is inguinal adenitis, which usually is very brief in its duration. But, as stated by Siredey, the angeioleucitis of the groin may extend to the iliac fossa, whence the inflammation may gain the peritoneum. "It should be remembered that the superficial lymphatics of the groin have two connections with those of the iliac fossa, one by vessels which pass through the cribriform fascia, and the other by the ganglion which generally occupies the orifice of the inguino-crural canal." Hence we may have phlegmon of the iliac fossa, and even peritonitis following an inguinal adenitis, which has resulted from a vulvar wound.

2. *Puerperal Diphtheria.*—Garrigues[1] contends against the view held by Speigelberg and most others[2] as to diphtheria of the genital organs in childbed, and maintains that it may affect the genital canal of puerperal women as one of the manifestations of puerperal fever, reporting several cases of the affection.

[1] Transactions of the American Gynecological Society, vol. x.

[2] Siredey, for example, says: "Whatever the thickness of the membranous exudate and the facility of its reproduction, it is impossible to confound it with manifestations of true diphtheria, and such a designation is objectionable because it brings some confusion to nosology."

He gives the following description: "The characteristic feature of the disease is the diphtheritic infiltration. This was in most of the cases I have seen of a light pearl-gray color, more exceptionally milk-white or sulphur-yellow. It makes its first appearance as discrete spots not larger than a millet-seed, but soon these spots extend in all directions and melt together, so as to form one or more large thick patches, firmly adherent to, imbedded in, and, as it were, dovetailed with the subjacent and surrounding tissue. The patches have commonly round contours, measure from one-eighth to one inch in diameter, and about one-eighth of an inch in thickness. . . . . All torn or abraded surfaces become more easily a prey to the diphtheritic infiltration. But, as stated above, I have repeatedly seen entirely healthy parts of the mucous membrane of the vagina, yet covered with epidermis and separated by intervening tissue from all tears and abrasions, become the seat of the affection. In one case the inside of the labia majora was alone affected. The parts surrounding the patches are more or less swollen, dark red, brown, or dirty greenish. The connective tissue of the small and the large pelvis is infiltrated with a turbid serous fluid, and sometimes the seat of hemorrhagic thrombosis."

In the local treatment Garrigues expresses a decided preference for chloride of zinc with an equal quantity of distilled water, and all the parts affected are to be touched with this solution.

3. *Uterine Lymphangitis.*—This is the most frequent condition causing mild puerperal fever. In most cases it begins with a chill the second or third day, followed by increased temperature, the mercury marking possibly only 101° or 102°. There is pain felt at one or both sides of the uterus, or if this be not spontaneous it may be caused by direct pressure at these points; the uterus is larger than it should be, and if movements are given to it by the fingers in the vagina pain is produced; no tumor can be felt either by abdominal or by vaginal examination; some nausea may be present, but there is no such excessive vomiting as occurs in peritoneal inflammation; instead of diarrhœa there is constipation, and the pulse is full and only moderately increased in frequency. After a few days the symptoms usually subside, and the patient enters upon convalescence. But should she now get up, or even without this exciting cause, a relapse may occur, and possibly there will be developed peritoneal inflammation, or inflammation involving the broad ligament or the iliac fossa. "In every lying-in woman who has fever lasting two or three days accompanied by pain upon pressure on the sides and at the cornua of the uterus, uterine lymphangitis ought to be suspected, and absolute repose should be insisted upon, until no pain is caused by palpation of the abdomen, and retraction of the uterus to its normal volume has occurred."

4. *Peritonitis.*—Two forms of this disorder are to be described: first, when the inflammation is limited to the pelvic peritoneum, and second, that in which it is general.

Pelvi-peritoneal inflammation may begin at the same time with uterine lymphangitis, or it may follow it; in the latter case there is often a second chill, indicating this extension of the disease. But whether with or without a chill, the most prominent symptom in the beginning of the affection is acute pain—the sharp, knife-like pain by

which inflammation of serous membranes so generally reveals itself. This pain is spontaneous, compelling the patient not only to keep her body immobile, but also to avoid coughing or a deep inspiration, and there is great tenderness upon pressure at one, or at each side of the uterus; the lower portion of the abdomen is swelled, and sometimes there are nausea and vomiting. The temperature usually is from 102 to 104°, but may be higher; and the pulse is from 100 to 120. Upon digital examination after the inflammation has been in progress a few days, a sensitive tumor closely attached to the uterus will be felt; it generally is more prominent in the posterior cul-de-sac, and extends on each side of the cervix like a crescent; or it may be situated on one or the other side of the uterus. In some cases it is as large as the fist, and then, if lateral, it can be recognized not only by vaginal touch, but also by abdominal palpation. Another characteristic of this inflammatory tumor, so well described by Bernutz, is that it causes more or less displacement of the uterus; still further, if the tumor is situated posteriorly to the uterus, it causes the disappearance of the corresponding vaginal cul-de-sac, the surface there presenting a convexity instead of a concavity; but if it be at one side of the uterus the corresponding cul-de-sac is broader and shallower, while that of the opposite side retains its normal depth, but is narrower. Displacements of the uterus and deformities of the upper portion of the vagina are marked features of pelvi-peritoneal inflammation.

The tumor of pelvi-peritonitis is at first not distinct and hard, but soon acquires these characteristics. It interferes with the normal mobility of the uterus, and is sensitive to touch; this sensibility is most marked at first, then gradually diminishing. The pain disappears in two or three weeks, and in the great majority of cases the tumor undergoes resolution. If suppuration occurs the inflammation, with associated symptoms, does not abate, but, especially after the formation of matter, fever, chills, pain, and frequency of the pulse continue; the purulent collection may open into the bladder, the vagina, or the rectum, or a general peritonitis may occur. Siredey regards this form of peritonitis—that is, when suppuration occurs—as, in favorable cases, lasting from four to six weeks, while in many others it lasts for months.

General peritonitis, as a rule, begins soon after labor; it may be only a few hours intervening, but oftener twenty-four or forty-eight. In some cases it is the consequence of pelvi-peritonitis, and then the disease is not manifested until several days later. It generally begins with a chill, more or less violent, which is followed by fever, frequent pulse, the latter often being 120 or more. The pain is that so characteristic of peritoneal inflammation, and need not again be described. The lochial discharge in a great majority of cases is very offensive; and so are the evacuations from the bowels, if, as frequently happens, diarrhœa occurs. The patient lies in one position, her breathing frequent and shallow, in consequence of the great abdominal tenderness and distension; the latter may be so great, encroaching so much upon the thoracic capacity, that the patient dies of asphyxia. Another reason for the difficult respiration is found in the associated pleuritis, which not uncommonly occurs, very frequently insidious in

its onset, and its symptoms masked by the violent peritoneal inflammation. Headache, mental disturbance, and sleeplessness are not uncommon. The disease is usually fatal, death occurring in the worst cases within the first two days, but usually not before the fourth or fifth day.

5. *Adeno-phlegmon.*—In this variety of lymphangitis the inflammation involves the lymphatic ganglia and the surrounding connective tissue. In almost all cases a chill is observed, and this is followed by fever and pain—a pain much less severe than that occurring when the peritoneum is inflamed. There is tenderness upon pressure at the painful part, which is situated upon one or the other side of the uterus, in some part of the course of the broad ligament, or in the vicinity of its pelvic attachment. The lochial discharge is offensive. The next manifestation of the disease is the appearance of a tumor at the seat of pain. This tumor may become so large as to fill the iliac fossa, if the lymphangitis occurs here; or, if the lymphatics of the broad ligament are affected, it will not only be manifested to abdominal but also to vaginal touch; in some cases, however, the tumor is quite small, as in the following report of a case in the Philadelphia Hospital:—

M. C., 22 years old, was delivered on January 10, 1884, of a living male child, weighing nine pounds, after a labor lasting nearly eighteen hours. In the evening the patient's temperature rose to 101.4°, and at twelve o'clock the next day it was 105°, the highest it was during her sickness, the pulse then being 138; there was no chill at any time. In a few days there could be felt in the right iliac fossa a hard, rounded nodule, which was very sensitive to pressure; there was no tenderness or tumor to be found by digital examination in the corresponding vaginal vault. Her fever lasted for nearly one month, in the course of which a similar tumor or nodule was found in the left iliac fossa; only three times for at least four weeks was her temperature normal, and then the condition lasted only a few hours. She completely recovered in eight weeks.

The remarkable features in this case, of which a brief abstract has been presented, were the early occurrence of the disease, the absence of a chill marking its invasion, the formation of a tumor in one and afterwards in the other iliac fossa, the small size of each, and the protracted course of the disease. The tumor resulting from adeno-phlegmon of the broad ligament, or of the iliac fossa, may disappear by resolution or by suppuration. If suppuration occur, the pus may find its way directly to the exterior through the skin, but in other instances the abscess opens into the rectum, into the bladder, or into the vagina.

6. *Phlebitis.*—As has been previously stated, there are two varieties of this—adhesive and infectious.

A. *Adhesive Phlebitis.*—This form of the disease, or phlegmasia alba dolens, usually occurs from the fourth to the twelfth day after delivery, but there may be an interval of two or three, or even of five or six weeks: "Considered successively as a milk-metastasis, a rheumatic affection, a neuritis, an inflammation," various theories have been advanced to explain this affection of women in childbed. The chief characteristics are pain and swelling of one of the lower limbs, this

swelling being of a white color. One of the oldest theories in regard to the disease is that which attributed it to a deposit of milk in the affected member, and which is perpetuated in the once-professional but now only popular designation of milk-leg. The theory of inflammation of the connective tissue, and then that which made it depend upon inflammation of the veins, probably were next in order. The last was advocated by Davis in 1817, and is now generally accepted. Inflammation of the lymphatics has been maintained by some as the cause. By still others it is claimed that spontaneous coagulation of the blood occurs in the affected vessels; the hyperinotic condition of the blood is an admitted fact, and then there is assumed an inopexia, which is the final agent in producing a physiological thrombosis, and the lesions of the walls of the vessel are consecutive to its spontaneous obstruction. As has been already stated, it is now generally held that phlegmasia alba dolens of childbed is caused by phlebitis—that phlebitis being an extension of the disease (as explained on page 575) from the vessels of the uterus.

Symptoms.—Pain and swelling are the most striking characteristics of the affection. Pain precedes the swelling, and in many cases is felt for some hours in the lower part of the abdomen at the pelvic inlet; possibly a chill occurs before the pain. With or without the pelvic pain first occurring, pain is felt below Poupart's ligament, and soon extends down the thigh to the leg. The swelling follows, and may begin in the gluteal region, or upon the upper anterior face of the thigh, thence extending to the leg and foot; the rapidity of the extension is so great that in some cases the entire limb is involved within a few hours. The swelling is so uniform that the limb has a cylindrical shape, or resembles a truncated cone, the base of which is at the upper end of the thigh; it is so great that sometimes the limb seems double its natural size. In most cases it is limited to the member, but in some it involves the hypogastric region. The skin is white, tense, and shining. By palpation, which ought to be done very gently, the obstructed veins are felt as solid, irregular cords. The limb is sensitive to pressure where the inflamed vessels are felt, but after the first day or two no severe spontaneous pain, but chiefly discomfort, is experienced; the member becomes inert, useless, the patient being unable to move it.

In almost all cases premonitory symptoms occur; in some the disease may appear in the course of a more or less severe attack of septicæmia, while in others there have been occasional manifestations of fever and abdominal pain, a sort of masked infection, and a threatening of more serious danger, or, at least, some deviation from normal convalescence. The occurrence of the disease without some prior evidence of a pathological condition of the uterus, or in its vicinity, is quite exceptional.

Progress and Termination.—Fever with some pain continues for about two weeks, and then in the great majority of cases the swelling begins to subside, the subsidence taking place very much more slowly than the accession. In rare instances the other limb is affected. Resolution is the usual termination, but the limb is a long time in re-

covering its lost power and natural feeling, but is, as has been said, like a wooden leg; even for months the foot and leg swell after exercise or standing. In some instances a permanent œdema is the result. Among the perils of the patient are breaking down of the clot with consequent general infection, or detachment of a portion of it with pulmonary embolism, and sudden or rapid death follows.

Periphlebitis may, in rare cases, complicate the phlebitic inflammation, and more or less extensive suppuration follow.

B. Infectious phlebitis is characterized by an initial chill followed by high temperature; the pain is not great when pressure is made upon the abdomen, and may be absent; the abdominal tympanites is absent, and the lochial discharge is offensive. The temperature changes very rapidly, abruptly rising or falling; chills occur at irregular intervals, these being a few hours, a day, or two or three days, and, as a rule, they are severer than those observed in lymphangitis; the fact that they are multiple instead of single, and their severity, will assist in making a diagnosis between the two affections. The great increase of temperature followed by a decline with more or less perspiration, and the recurrence of chills with new accessions of fever, led Osiander to thus speak of the distinction between this form of puerperal septicæmia and intermittent fever:—

"This fever differs from the common cold or intermittent fever which attacks women in childbirth sometimes, or with which they oftentimes pass from pregnancy into childbed, and which, according to the testimony of writers, Torti, for example, is always very dangerous, but which can generally be cured by the use of the Peruvian bark, in this respect: at the time between the attacks a real abatement of the feverish pulse cannot be perceived, and the chill never occurs at a definite or regular time."

While intermittence characterizes the disease in the beginning, after a time the fever becomes continuous. But the chief characteristic of infectious phlebitis is the general distribution of the poison through the economy so that there is not an organ or part which may not be involved; very frequently the lungs and pleuræ are invaded with disease; for example, out of seven fatal cases under my charge at the Philadelphia Hospital, two died of pneumonia, in a third pneumonia was a complication of other lesions, and in a fourth there was double pleurisy. Disease of the heart, and especially of the kidneys, of the liver, of the spleen, of the brain or of the meninges, and less frequently of the organs of special sense, as the eye,[1] may be among the consequences of infectious phlebitis. Further, it may manifest itself in affections of the joints, of the sheaths of tendons, of the connective tissue in various parts of the body, or of the muscles themselves, or of the bloodvessels, especially the veins.

1 "Inflammation of the eye is probably always the result of embolism, and it generally involves the entire globe, ending in its destruction. I have seen this accident in three patients, and in one both eyes were affected. Out of thirteen cases of panophthalmitis from embolism, published by Hosch, twelve died. According to Litten retinal hemorrhages in septic fevers without endocarditis, occur partly as the only change in the eye, and partly in the course of severe purulent ophthalmia. He considers them as caused by embolism, and, in doubtful cases, thinks them of great diagnostic value." (Spiegelberg.)

Siredey describes three forms of infectious phlebitis, the first is that which is most acute, *forme foudroyante*, rapidly fatal, killing as if by a thunderbolt; second, the typhoid form; and third the late or delayed form. The last may not occur until eight or fifteen days after labor; this is the least fatal, but the patient is many weeks in recovering, should recovery take place; in one case under my care the first manifestation of the disease was nine days after labor, and when it had been in progress about three weeks phlegmasia alba dolens appeared, which must be regarded, if manifested in the course of the disease, as auspicious, for it indicates a favorable condition of the blood, and thenceforth the probable limitation of the disease to the affected limb; more than three months elapsed from the beginning of the attack before the patient could be pronounced completely convalescent.

It must be remembered that, while in many cases septic lymphangitis and phlebitis can be distinguished, in many others both forms of the infection are present, and thus a confused picture is presented, in one case, or at one time, the features of one or of the other affection predominating.

Further, in a disease which presents such protean forms as puerperal septicæmia, it is impossible within the brief compass of a few pages to even hastily sketch them all, and to trace the various symptoms and lesions; nevertheless the recognition of the disease at the bedside is rarely difficult, and therefore it is unnecessary to consider its diagnosis under the head of a special topic.

Prognosis.—The sooner the disease occurs after labor the more unfavorable the prognosis; violent uncontrollable vomiting, very great abdominal distension, a notable quantity of albumen in the urine, severity of pain, especially if it should be followed by sudden cessation, are likewise to be held as unfavorable indications, and to these must be added great frequency of the pulse. The severity and the repetition of chills are causes of anxiety; the character of the epidemic, should the disease then occur, gives information as to the probable result, for some epidemics are marked by great fatality, while others are mild. Should pneumonia occur, the result will probably be fatal; at least I have never seen a septicæmic patient recover when thus affected, but I have seen several die. The temperature is less important in reference to the prognosis than the pulse; thus in one patient who died of pneumonia the seventh day, the temperature was only 101° the day before death, while in another, whose death did not occur until the sixth week, the thermometer during the last ten days showed only once an elevation above 100°, and most of the time it was little above 99°, but at the same time the pulse was from 120 to 140, and once 144.

After stating those symptoms which are unfavorable, or even which may indicate certain death, it may in general be said that the opposite conditions give good ground for hope of recovery. But on the one hand, the practitioner should not be too confident even in apparently a slight lymphangitis, or in a limited pelvi-peritoneal inflammation that the patient is safe; most probably she is, but a great fire may be kindled by the smallest spark, and the trifling disorder may be

but the forerunner of a rapidly mortal manifestation of septic infection. On the other hand, it is his duty not to lose hope even in apparently desperate cases, when the shadow of death seems to be resting upon the unhappy victim, for by the judicious use of therapeutic means he will in some, if not in many, cases have the supreme happiness of seeing recovery reward his efforts; more than once patients in the Philadelphia Hospital, whom others, as well as myself, thought must die, were saved.

Sudden Death.—Before presenting the treatment of puerperal septicæmia a few words will be said in regard to one of the accidents which may occur in childbed in some instances dependent upon this infection, but in most independent of it, an accident which is happily rare; reference is made to sudden death. Writers have included under this designation not only cases where life was lost instantly, but also those in which a fatal result occurred in the course of a few hours; strictly speaking, only the first can be called sudden, while the latter would more appropriately be termed rapid death. Nevertheless the law of common use will be observed.

Dubois has just delivered a woman of her child, and after giving his attention to the latter turned to the mother whom he found in a syncope which was quickly mortal; the cause of death was uterine hemorrhage. Meigs has very graphically described cases of death from heartclot, and especially called the attention of the profession to the subject in 1849, but in no case that he has narrated in his work upon obstetrics has he given an instance of what can be appropriately called sudden death, indeed one of the patients did not die until seventeen days after the first manifestation of the accident. Nevertheless he has distinctly stated that death may occur from this cause suddenly. Kleinwächter gives support to Meigs's view as to the way in which a cardiac clot may form in the living; he states that in consequence of the increased quantity of fibrin, the anæmia that may be present, and the excessive action of the heart, the blood may clot in the heart, or in the pulmonary artery, and death instantly occur. Meigs, it is to be remembered, not only included the causes just mentioned, but also explained the beginning of the formation of the clot by the syncope following exertion, and this explanation has been entertained by Gosselin.

Very striking illustrations of sudden death in childbed from pulmonary embolism, the embolism being caused by the detachment of a physiological thrombus formed in a uterine vein, or from a thrombus in a pelvic, or in the crural vein have occurred. The following is an illustrative case cited by Maurice Coste:[1] Three days after delivery a woman had a phlebitis of the left lower limb, but it yielded to appropriate treatment; while convalescing, and on the nineteenth day after making a slight exertion, she gave a cry, fell back and died: the autopsy revealed clots in the crural and iliac veins, and a similar

[1] De la Myocardite Puerpérale comme cause le plus fréquente de mortes subiter apres l'Accouchement.

coagulum in the pulmonary artery extending to its finest ramifications. This history has its important lesson for the practitioner, teaching that he must insist upon absolute rest for a patient suffering with phlegmasia alba dolens until danger of detachment of a portion of the coagulum in the affected vessels has passed.

Hervieux has maintained that the "puerperal poison" may be a cause of sudden death, the quantity received so great, and the condition of the subject such that a fatal result occurs without the usual manifestations of the disease. He strengthens this view of a rapidly fatal result occurring from "*puerperal empoisonnement*," by referring to a similar effect being produced in certain severe epidemics of other acute diseases, as, for example, smallpox and scarlet fever. He divides the cases of sudden death from puerperal infection into two classes, the first including those of prompt death, and the second those of properly termed sudden death, the former class embraces those in which the autopsy reveals some appreciable lesion, and the latter those in which no alteration is discovered which can explain the fatal issue. The entrance of air into the uterine veins may cause sudden death; it is admitted by all that such entrance has occurred artificially, as when an intra-uterine injection has been carelessly given, air being thrown into the uterine cavity with the liquid used; its spontaneous entrance is doubted or denied by excellent authorities, yet this hypothesis is the most rational explanation of some cases of sudden death following soon after the delivery of the placenta, though Hervieux claims that the supposed air found at autopsies in the vessels in the heart is really gases which have probably been spontaneously developed during life: it should be added, however, that sudden death may occur in the puerperal woman from the presence of these gases in the circulation.

Kleinwächter mentions acute pulmonary œdema as a cause of sudden death, and suggests that it is probably dependent upon the same causes that lead to spontaneous coagulation of the blood, and a case reported by Warren,[1] gives support to this view.

Hervieux includes among dynamic lesions of the nervous centres as causes of sudden death in childbed nervous exhaustion, and emotional disturbance. Where labors have been very protracted and attended with much suffering, their termination may be followed by a fatal result. As to the latter cause mentioned, Morgagni[2] has stated that a woman in her second pregnancy earnestly desiring a son, after the child was born, ascertaining that it was a girl, was plunged in so profound a disappointment that she died in six hours, and Travers has also given an instance of death of a puerpera six hours after labor, the cause being sorrow that her child was dead.

It is not necessary to enumerate the different causes of acute hemor-

[1] American Journal of Obstetrics, November, 1884, page 1121.

[2] In the case of the daughter-in-law of Eli, the wife of Phinehas, we have an illustration of the influence of a profound mental impression, or shock, causing premature labor, and then death. Sacred history tells us that under the conjoined influence of the disastrous defeat of the Jewish army, with the loss of the Ark, the death of her husband and his brother, and then of their father, these events rapidly occurred in her case.

rhage after delivery resulting in sudden death, nor to more than mention that such death may be the result of eclampsia, of pulmonary congestion or apoplexy, of ruptures of the heart, the latter accidents having been observed in the puerperal state from aneurismal dilatation, from fatty degeneration, or from hydatid cyst of its walls, and especially from valvular lesions and myocarditis.

Coste, indeed, takes the following position—one in which he has not, however, been sustained by authorities—that as sudden death after delivery is due to a hemorrhage, or to a thrombosis of the pulmonary artery, or to a myocarditis, and as the hemorrhage more especially produces death more or less rapid, and thrombosis of the pulmonary artery appears to be caused by the degeneration of the myocardium, it may be concluded that sudden death after labor is almost always the result of a myocarditis.

While the professional attendant is powerless in the presence of the great and sudden calamity, he, at least in most cases, can for the satisfaction of friends explain its cause, and where the event is threatened, may, by suitable prophylaxis in some instances, prevent its occurrence.

Treatment of Puerperal Septicæmia.—The most important part of this treatment is prophylactic, and the prophylaxis includes precautions taken before, during, and after labor; it extends to the nurse, and to the practitioner, and to the patient. As far as the practitioner is concerned, Spiegelberg has laid down the judicious rule that he should not have been attending patients with infectious diseases or have had anything to do with infectious products shortly before attending a labor.

French, in a discussion[1] of the question, How soon after exposure to sepsis may the accoucheur resume practice? adopts as his conclusion the statement of Esmarch: "If you have thoroughly disinfected yourself, you can immediately enter upon obstetric practice. Time does not destroy septic dirt." The last statement, which also appears essentially in a previous part of the paper, may be controverted, for, as Fritsch has said, a mechanical disinfection can be made; "if during the days which follow an autopsy the hands are washed a dozen times a day it is certain that, at the end of two or three weeks, the superficial epidermic layers are detached and with them all matters attached to them, so that it is not possible for bacteria which adhered to the fingers from the autopsy to remain." While, in his interesting article, French has adduced instances in which he attended cases of labor shortly after his hands had been exposed to septic fluids without the women having puerperal septicæmia, of course resorting to careful disinfection of his hands, and while he quotes distinguished authorities in favor of his thesis, it would be safer not to accept his conclusion as final, but rather observe the wise precaution advised by Spiegelberg.

Vaginal examinations during labor should be few and brief, and never made without disinfection of the hand preceding each one. Introduction of the fingers into the vagina after labor and during the puerperal state can very rarely be necessary, and should only be done with strict antiseptic precautions, including not only the disinfection of

[1] Journal of the American Medical Association, July 4, 1885.

the fingers, but also an antiseptic injection before and after the examination. Some obstetricians—prominent among whom is Garrigues—advise the use of a special antiseptic pad, applied to the external generative organs during the lochial flow; but this is hardly necessary, except in a maternity when epidemic septicæmia is present, and the practitioner may be content to direct that the napkins should be sprinkled with a warm solution of corrosive sublimate before their application, and using a similar one for daily cleansing the external genitals.

Practitioners who have never met with puerperal fever may underrate the value of antiseptic obstetrics, and neglect necessary precautions until startled from the fancied immunity their patients have by a fatal case of the disease. Nevertheless this value rests upon incontrovertible facts. Thus, quoting from Fritsch: "While in the Charité of Berlin the puerperal mortality in the winter of 1859 was 16 per cent., and in that of 1861, 13 per cent., it has been reduced by Gusserow to 0.9 per cent., and at Strasburg to 0.27 per cent. Results equally brilliant have been obtained by Breisky, 1 death in 527 deliveries; and by myself, not a single death in 300." Professor Winckel has recently informed me that in the Maternity under his charge at Munich, with several hundred labors each year, and with the constant teaching of clinical obstetrics, the mortality under the use of antiseptics is only from $\frac{1}{2}$ to $\frac{3}{4}$ per cent.

In the face of such facts, which might be greatly multiplied, he is an unwise, if not an unfaithful, obstetrician who does not throw around the puerpera every possible protection against the entrance of septic germs through the gateways opened by the necessary traumatisms of labor.

The curative treatment is local and constitutional. The former will be first considered, as it really is the first in importance.

When the puerperal woman has continuous fever, either with or without a preceding chill, and the elevation of temperature is not connected with inflammation of the nipple or of the breast, the presumption is she is suffering from septic infection; this presumption becomes a certainty if she has pain and tenderness in the lower part of the abdomen, and uterine involution is arrested. It may be asserted by the nurse that the lochial discharge is not offensive, or that it has been arrested; but the practitioner ought to examine the soiled napkins himself, or if the flow be absent, ascertain by conjoined manual examination whether, in consequence of a uterine flexion, the discharge is not retained in the uterus, in a word, whether there is not lochiometra. Offensive lochia indicate at once copious antiseptic vaginal injections, repeated twice or thrice, or even oftener, in the twenty-four hours; these the nurse may give with a fountain syringe. But if the fever persists, and the abnormal character of the flow is not entirely removed, then intra-uterine antiseptic injections must be employed, and repeated twice in the twenty-four hours. For these injections, which should be given by the practitioner, some advise a glass tube, and one of the best is Chamberlain's; Fritsch, however, prefers Bozeman's catheter, and it can be highly recommended. In regard to giving the injections the following important remarks are made by Fritsch:—

"When uterine contractions excited by the injection washing of the uterus in part and in part by the force of the jet, sometimes detach decomposed and putrefying débris of the caduca; the débris are not evacuated until the next injection. In cases—and they are the most numerous—where the injection is followed by a favorable result, in this that the temperature falls, but is subsequently elevated, there should be no hesitation. We ought not to content ourselves with the first injection, but repeat the operation in order to secure a definite result. Very often the secretion increases, it is said, under the influence of the intra-uterine irrigations, and the treatment causes a more abundant production of pus and lochia. But one will observe at the same time that the uterus, swelled and softened, has become smaller. This fact is easily explained: the injections make the cervical canal more permeable to the secretions, and hence they escape more readily. The retraction of the uterus is still another indication of cure; the uterine muscular tissue, which was relaxed, infiltrated, and inflamed, recovers its functions and better accomplishes its work of expulsion. The organic débris still adherent are detached, and the process of desquamation, which precedes regeneration of the mucous membrane, is accelerated. When the intra-uterine injections bring out nothing, and this is easy to ascertain, they are to be abandoned, only vaginal injections being used. But should the uterus return to its enlarged and softened condition, it is necessary to resume the treatment of its internal surface."

In those unfortunate cases where manual detachment of the placenta has been necessary, or has been thought to be required, and, as is usually the case, placental fragments are left behind, the occurrence of septic fever indicates not merely the use of intra-uterine injections, but if these fail the removal of such placental fragments with fingers or forceps, or with the dull wire curette; some practitioners use Simon's spoon.

In one case of septicæmia at the hospital which followed artificial and incomplete removal of the placenta, there were persistence of the fever and offensive flow, notwithstanding antiseptic intra-uterine injections given twice a day, until in the third week when I dilated the cervix with Hegar's dilators, and found in the uterine cavity at least two ounces of very offensive purulent matter; after its evacuation, I removed with Emmet's curette forceps, with a polypus forceps, and with Recamier's curette a tablespoonful of partially decomposed placental fragments—within twenty-four hours the convalescence of the patient began.

The antiseptic solutions generally used for injections are those of carbolic acid, or of corrosive sublimate; if the former is selected, a 3 per cent. solution may be employed for vaginal or for uterine injection, but if the latter, 1 to 2000 or to 3000.

It will be convenient in presenting the general treatment to first mention the chief remedies that have been or may be employed.

Depletion.—Meigs in referring to blood-letting speaks of it as "*the* method, and is preferable to all others; and, moreover, so very likely to cure, when duly and timely applied, that I cannot conceive of any other to be compared with it for excellency and safety. Indeed, I reiterate that the case which admits not of this method is one to be cured through the goodness of Divine Providence, and not by the vain means left in our power after the subtraction of the prime and chief

of them." On the other hand, Siredey has recently said that among the antiphlogistics general bleeding has been abandoned, that it is without any demonstrated influence upon the progress of the phlegmasia—he is referring to that form of the disease characterized by peritoneal inflammation—and without any influence upon the local pain, its effect is to increase without any gain the feebleness of the patients, when it is of the greatest importance to save their forces. Another objection to bleeding is that, admitting the disease depends upon the entrance into the economy of an infectious element, no matter whether chemical, or a *contagium animatum*, we invite new absorption of the poison by such treatment. But while general bloodletting has been justly abandoned, local depletion by means of leeches applied to the abdomen over the seat of pain, is often very useful in pelvi-perionitis.

Emetics.—Doulcet received from the French government a reward for discovering a cure for puerperal fever; that cure was ipecacuanha. But neither it nor any other emetic is prescribed now for any specific effect in the treatment of septicæmia.

Purgatives.—These can only exceptionally be useful, for the bowels have been thoroughly evacuated during labor; and when the disease is attended with peritoneal inflammation they may do great harm.

Antipyretics.—The reduction of temperature may be effected by means of the cold bath, or by wrapping in a wet sheet. Spiegelberg warmly advocated the cold bath, stating that it was indicated by continuous high fever, by the irregular chills of phlebitic septicæmia, with slight remissions, and in all cases where the general evil results of an elevated temperature are present. This treatment is also upheld by Fritsch. He states that the temperature of the water should be from 72.5° to 86°; if the patient has severe shivering the temperature may be raised to 93°, then reduced to 72.5°; she should remain in the bath for ten or fifteen minutes. If decided reduction of her temperature is not obtained, that of the bath is to be lessened; prolonged immersion does not produce as good effects as lowering the temperature of the bath. Lusk commends the use of the coil of metal or rubber tubing, through which, after its application to the person of the patient, cold water is passed. The application of a bladder, containing ice broken in small pieces, to the abdomen, is advocated both by Siredey and Fritsch among others. It is suitable in peritoneal inflammation, lessening pain and diminishing the area of inflammation. Whether a bladder or rubber sac be used, a fold of flannel should be interposed between either and the skin. This remedy is useless or injurious after exudation has occurred. Where neither cold baths or the wet sheet, nor the cold coil is used, frequent sponging the surface with cool water may be employed. Nevertheless, the application of cold is not useful in all cases. The following observations by Dr. Barker[1] are very important in this connection. This eminent authority, referring to refrigeration as a means of reducing fever, in puerperal diseases, states that his experience with it has not been favorable:—

[1] Medical News, Feb. 16, 1884.

"Many years ago I tried it in several cases in Bellevue Hospital, but I soon gave it up. Cold will effectively and usefully reduce the temperature in active inflammations and in acute fevers; but in adynamic diseases and in hectic fever this must be attended with a rapid waste of tissue more dangerous than the pyrexia. In three cases which I have seen, with others—two a year ago and one this winter—where the coil had been kept assiduously over the abdomen, most of the time two or three days, the conditions in each were remarkably similar. The abdomen was blanched, colorless, and not sensitive to pressure; the patients all avowed that the coil gave them great comfort, but the temperature was very high in all—in one 104.3°, and in the other two over 105°. The pulse was very rapid and feeble; the heart's action extremely weak, with pulmonary symptoms—such as short, rapid, and shallow respiration—which caused grave apprehension lest there might be latent centric pneumonia. After some discussion I induced my friends to remove the refrigerating coil, and in its place to cover the abdomen with flannel saturated with the oil of turpentine, for the purpose of stimulating vaso-motor action, restoring the capillary, and equalizing the general circulation. All were taking quinine in large doses. This was greatly diminished or wholly stopped, and digitalis and ammonia in full dose were substituted. In a few hours the change in each of these cases was most remarkable. The temperature was reduced from two to three degrees, the pulse was greatly lessened in frequency and increased in force, and all pulmonary symptoms, which had caused so much anxiety had disappeared."

It may be remarked in connection with the observations of Dr. Barker as to applications to the abdomen, that in case of much abdominal tenderness or tympanitis, flannel cloths wrung out of very hot water, and sprinkled with oil of turpentine are among the best; they should be used every six hours, and there ought to be some reddening of the skin produced by each application; during the intervals light warm poultices of ground flaxseed, or three or four thicknesses of flannel saturated with warm water may be applied, and over either a covering of oiled silk placed to prevent wetting the patient's clothes.

Medicines are administered internally for the reduction of the temperature, chief among these are quinine, salicylic acid, salicylate of sodium, antipyrine, and alcohol. Fritsch advises quinine, preferably the muriate, by rectal injection, the dose being fifteen grains. Whether given by the mouth or rectum the dose should not be less than ten or fifteen grains; on the other hand, doses of twenty or thirty grains add to the discomfort of the patient, and probably do no more good than the smaller amount. It has been especially advised in the remittent form of the disease, given at the time when the temperature has fallen in order to prevent or lessen the following elevation of temperature; it much more frequently fails than accomplishes the desired result. Salicylic acid and salicylate of sodium in doses of ten to twenty grains may be used once in four hours, the salt being preferred to the acid, until four doses have been taken, when if no benefit results the treatment may be discontinued. Even if the temperature is reduced by either of these remedies the effect is usually quite transient; and in cases where we wish to keep the digestive powers as nearly normal as possible, so as to secure sufficient strength for the patient that she

may be safely carried through an exhausting and protracted illness, it is best to avoid frequent and large doses of these or of other medicines. Antipyrine has recently proved one of the promptest and most efficient antipyretics in puerperal fever; a dose of ten or fifteen grains will materially reduce the temperature in most cases within one or two hours, and if this effect is not produced by a single dose it may be repeated. Another benefit claimed for antipyrine is that having the power of contracting the capillaries, it lessens the liability to fresh absorption of the septic poison. The fall in temperature secured by this medicine is of course only temporary, and is sometimes attended with profuse sweating and great prostration; it may then be questioned whether the evil is not greater than the good. It should also be remembered that while a high temperature brings danger, yet its reduction does not cure, and little or no effect upon the course of the disease is produced by this or similar agents.

Alcohol is probably the most valuable of internal remedies. In[1] considerable doses it lessens the temperature of the body, and this effect is more marked in pyrexia than in the normal state; Siredey speaks of it as at once tonic and antithermic; Spiegelberg has referred to it as "successfully used for a long time by English physicians in acute febrile diseases, its antipyeretic action has since then been established also experimentally, and in its practical application we have had successful results;" Fritsch observes that alcoholic drinks should be given freely, and recalls the observation of Conrad that large doses of alcohol cause better sleep. Nevertheless, all cases of septicæmia do not require this remedy, probably the majority will get on as well without it, nor is it usually advisable to administer it at the beginning of the disease. In the hospital cases for which it was prescribed whiskey was used, the quantity varied from eight to sixteen ounces in twenty-four hours, and it was given at regular intervals in conjunction with milk, or in the form of eggnog.

Richardson urges that when alcohol is given in disease, it should be given as alcohol, and not in the form of wine, brandy, rum, whiskey, or any other form of alcoholic drink. He observes that so many ounces of wine, brandy, or whiskey means nothing at all that is reliable, but if alcohol be used the therapeutical action is reduced to a positive method. If the remedy be used in the latter method, there is less danger of creating a constitutional appetite.[2] These arguments deserve consideration by physicians. When we see such a vast amount of disease, suffering, and crime caused by the use of alcoholic beverages, we must beware lest we contribute in the least to the terrible flood. Moreover, if we administer alcohol as alcohol, and not in the form of whiskey, or other alcoholic drink, there is less probability of a nurse making a blunder in the quantity to be given, for more than once patients have been killed by such blunder, a far greater quantity than that directed by the physician being given.

Opium.—This remedy is frequently indicated to relieve pain or restlessness, or to check frequent evacuations from the bowels. In 1848 Dr. Alonzo Clark first applied the opium treatment, which he had em-

[1] Bartholow, op. cit. [2] The Medical Profession and Alcohol.

ployed from 1841 to peritonitis from intestinal perforation, to puerperal peritonitis with success. The following is an extract from a letter written to me in 1876 by Dr. Clark:—[1]

"Regarding the rules, I begin with two grains of opium, or its equivalent opiate, and in two hours give the same, or more, or less, according to the effects produced. Patients resist or yield to the narcotic effects of the drug very differently. In some cases twenty-four grains of opium a day is all that is required; in a few, twelve or sixteen grains is sufficient. In most, two to four grains at a dose are needed; in a few, more than this. The aim is to get and maintain the symptoms of safe narcotism, or, as I sometimes term it, semi-narcotism, indicated by subsidence of the pain, contracted pupils, itching of nose and skin, a continuous sleep, from which, however, the patient is easily aroused, reduced frequency of respiration, followed by reduced frequency of the pulse, and absolute quiet of the bowels. Regarding the respiration, the aim is to reduce its frequency to twelve in the minute, and in the attempt to do this it is often found to fall as low as seven without danger, if the opium is then withheld for a few hours, till it rises to ten, when a smaller dose is given, to be increased or not afterwards."

Nourishment.—It is essential that easily digestible food should be given the patient in sufficient quantities and at frequent intervals. Milk, animal broths, beef-tea, and egg beaten up with wine or brandy may be used. Care should be taken not to weary the patient with the same kind of nourishment, but change from one to another each time when food is given.

Treatment of Special Conditions and Manifestations. Nausea and Vomiting.—Iced and effervescent drinks may be given—champagne often proves useful. A blister to the epigastrium, or ether-spray can first be tried; some cases are relieved by taking small quantities of hot water, as advised by Keith in the vomiting following ovariotomy; if other means fail, the hypodermatic injection of morphia will generally succeed.

Constipation.—In peritonitis an evacuation from the bowels may be had once in three days; this can generally be secured by an enema of warm water and soap or salt; but if not, a mild laxative should be given.

Great Pain and Abdominal Tenderness.—Turpentine stupes, followed by the application of cloths wrung out of hot water, will give some relief; the application of ice to the abdomen frequently produces remarkable alleviation of pain; opium, however, or morphia must be employed in cases where this suffering is severe. Another remedy, once more frequently used than now, and which in many cases brings notable relief to pain, is the application of a blister; the special object sought by this means was revulsion. Now, however, the remedy is seldom employed early in the disease, but later, and in those cases where it is desired to hasten the resolution of an inflammatory deposit, as in one of the broad ligaments. For the purpose just mentioned

[1] Author's Address on Obstetrics, International Medical Congress of Philadelphia, 1876.

various forms of counter-irritation are resorted to, for example, the application every few days of Churchill's tincture of iodine.

Intestinal Tympanites.—This may be lessened by stimulating applications to the abdomen, by a stimulating rectal injection, or by the introduction of a rectal tube; but where the distension is so great as to imperil life, the practice first advised by Paré may be employed, and capillary puncture of the intestine has been successfully performed by Depaul in a case of puerperal fever.

Intra-Peritoneal Effusions.—As Speigelberg has suggested, from the favorable results which have been had by reopening the abdomen, when a septic peritonitis has followed an intra-abdominal operation, and drainage, we may expect benefit from similar means in the septic peritonitis of childbed. But he has also presented the importance of resorting to this treatment early, and also the hindrance to success that lies in selecting suitable cases, for it can only be applicable to those where the effusion is chiefly liquid, and not to such as are attended with adhesive inflammation and fibrinous deposits.

The Treatment of Phlegmasia Alba Dolens.—Active treatment of this manifestation of puerperal septicæmia should not be employed, and hence leeching, cupping, and blistering, which were once used, are to be rejected. In regard to the last, Siredey says he positively proscribes blisters because of the injurious action which they have upon the kidneys, and of the predisposition to gangrene of a member whose circulation is profoundly disturbed. As the greatest peril to life in the affection arises from the detachment of a portion of the clot and consequent pulmonary embolism, the limb should be kept at perfect rest, and all friction of it avoided. Barker advises elevating the limb at an angle above the trunk by raising the lower part of the mattress, "not so much to favor the gravitation of fluids back toward the trunk, as to retard the gravitation of the blood toward the limb." Siredey, however, objects to the elevation of the member on the ground that it facilitates the detachment of clots, and he directs it to be kept in a horizontal position. Certainly the elevation does not add to the comfort of the patient, and it is better to follow Siredey's direction. The affected member should be protected from the pressure of the bedclothes, and wrapped in cotton batting, then covered with oil-silk. Where there is great pain in the limb, Barker advises a liniment composed of six ounces of the compound soap liniment, one ounce and a half of laudanum, and half an ounce each of tincture of aconite root and extract of belladonna. Opium will be necessary in many cases to relieve pain and restlessness and to secure sleep. If there should be much fever, quinine in antipyretic doses is indicated.

After all fever has ceased, and the pain and œdema have disappeared, the patient may be changed from the bed to a lounge, then in a few days sit for a while in a chair, and after this she may stand or walk; an immediate change from the horizontal to an erect position must be positively forbidden. When she begins to use the limb, a properly applied bandage adds very greatly to her comfort, and to some extent prevents the swelling which may for some months occur after standing or walking.

PART V.

OBSTETRIC OPERATIONS.

CHAPTER I.

THE INDUCTION OF ABORTION AND OF PREMATURE LABOR—CEPHALIC, PELVIC, AND PODALIC VERSION.

The Induction of Abortion.—The induction both of abortion and of premature labor for therapeutic purposes belongs chiefly if not exclusively to modern obstetrics. In the one instance the operation is done for saving the mother's life, and in the other to save that of the infant also.

Historical Notice.—Artificial abortion was frequent in ancient times, without regard to saving the mother's life. In the Republic of Plato its production is authorized in certain circumstances.[1] Aristotle not only did not condemn the practice, but even "desired that it should be enforced by law, when population had exceeded certain assigned limits." Lecky[2] remarks that the general opinion among the ancients seems to have been that the fœtus was but a part of the mother, and that she had the same right to destroy it as to cauterize a tumor upon her body. It seems to have resulted among the Romans not simply from licentiousness and poverty, "but even from so slight a motive as vanity, which made mothers shrink from the disfigurement of child-birth." The practice was avowed and universal. Ploss[3] refers to the prevalence of abortion both in civilized and savage nations, this prevalence being especially great among orientals, because of the slight value attached to the life of the fœtus. The maternal instinct, which acts as a check to the crime, is counterbalanced among the Mahommedans by the severe punishment inflicted upon a woman who has an illegitimate child.

Christianity was the most influential factor in revolutionizing Roman sentiment, and to-day is the most powerful protection of the unborn babe. Lecky, after stating that the average Roman in the later days of Paganism thought artificial abortion only a venial crime, scarcely deserving censure, says, "The language of the Christians from the very beginning was very different. With unwavering consistency and with the strongest emphasis they denounced the practice, not simply as inhuman, but as definitely murder. In the penitential discipline of the Church abortion was placed in the same category as infanticide, and the stern sentences to which the guilty person was subject, imprinted on the minds of Christians, more deeply than any mere exhortations, a sense of the enormity of the

[1] Jowett's translation, vol. iii. p. 343. [2] History of Morals in Europe. [3] Op. cit.

crime." Fortunate is that people or that community where this sentiment prevails, reinforcing civil law, and strengthening the teaching of medical science in regard to artificial abortion, when resorted to from any other motive than the salvation of the mother's life.

Kleinwächter states that it appears from the writings of Aspasia, fragments of which have been received through Ætius, who lived in the fifth century, that the ancient Greeks resorted to abortion in narrow pelves. With the extension of Christianity, however, even this form of abortion disappeared, and was only preserved among the Arabs, as we learn from Rhazes and Avicenna. Further reference to this operation is not made. It reappeared in the middle of the seventeenth century, when it was recommended by the famous German midwife, Justin Siegmundin, for placenta prævia; but it seems most probable, notwithstanding Kleinwächter's statement, that she adopted this practice from French obstetricians. It was employed first in England by W. Cooper in 1717, in order to avoid the great mortality of the Cæsarean operation. It was recommended for the same reason by Scheel in Copenhagen, in 1799. It was warmly advocated by Mende in Germany, 1802, and by Fodéré in France, 1835, and subsequently by Dubois and Cazeaux.

Indications for Artificial Abortion.—These indications may depend upon some general disease of the mother, or upon some local disease or deformity, or upon disease of the ovum.

1. Whenever the mother is suffering from disease arising from the pregnancy or originating before it, or accidentally occurring during it, which imperils her life, and there is a reasonable probability that she will recover if abortion occur, its induction is indicated. Among these diseases may be mentioned the uncontrollable vomiting of pregnancy, and, in some cases, chorea, hydræmia, and the nephritis of pregnancy: in regard to the last, see pages 247 and 249. Breisky includes pernicious anæmia among the diseases that indicate abortion; but Kleinwächter denies this, asserting that a fatal termination is hastened by it.

2. In case of such obstruction of the birth canal, either from pelvic deformity or from neoplasms, that a living child cannot be born through the natural passage even if premature labor be induced, and especially if the obstruction be so great that delivery is impossible after embryotomy, the indication for abortion is by most regarded as clear. This much all must admit: that a plain statement of the facts should be made to the pregnant woman, and then let her take her choice between such operation and the removal of the fœtus at the expiration of pregnancy by the Cæsarean section. There is no doubt as to what that decision will be in nine cases out of ten; and certainly, even if embryotomy be possible at the end of gestation, an early abortion will be less dangerous. Charpentier makes no doubtful statement as to the duty of the practitioner under these conditions..

In accordance with our masters, we admit not only that one can, but that one must perform abortion in all cases where there is considerable narrowing of the pelvis—that is to say, below 6 centimetres, 2.3 inches—so that the child cannot be born spontaneously with the forceps, but still embryotomy is so difficult that the life of the mother is endangered.

3. Certain uterine displacements render abortion necessary. These are retroversion or retroflexion with incarceration, and at least most cases of irreducible procidentia.

4. Diseases of the ovum may render it necessary. The embryo or fœtus may be dead, and the consequences of missed abortion may be present; detachment of the ovum may have occurred, and hemorrhage require that the pregnancy should be ended, or the same indication be presented by cystic degeneration of the chorion.

Prognosis and Means.—The prognosis will depend upon the condition of the patient and the cause rendering the operation necessary; it is generally favorable. Various means, too well known by professional abortionists, will interrupt the pregnancy. Medicines have been given internally, electricity used, and intra-uterine injections or puncture of the membranes employed; the safest way will be dilatation of the cervical canal with tupelo or sea-tangle tents, or partial detachment of the membranes. Of course whatever method is used great care must be taken to avoid septic infection, and after the abortion the same rest and precautions must be taken as after labor.

Induction of Premature Labor.—The object of this operation is usually to secure the birth of a living child, but it may be employed in certain dangerous conditions of the mother. In the first case the cause most frequently requiring the operation is pelvic narrowing, and as upon the degree of that narrowing, and the supposed size of the fœtus, the time when labor is to be brought on will be determined, it is important that these should, as far as possible, be ascertained. In regard to the degree of narrowing in reference to the time when labor should be induced, the following rules are given by Charpentier:—

1. In the case of a multipara, if the antero-posterior diameter of the inlet is 9 centimetres, 3.5 inches, labor should be brought on between eight months and one week and two weeks; but in the case of a primipara, her child being smaller, the practitioner may wait until the end of gestation, or at least not induce labor until eight or ten days before.

2. When this diameter is only 3.5 centimetres or 3.3 inches, labor should be brought on at 8 months or not later than 8.5 months.

3. If the measurement be 8 centimetres, 3.1 inches, induce labor at 8 months or 8.5.

4. If the measurement is 7.5 centimetres, 2.9 inches, labor should be brought on between 7.5 months and 8.

5. When this diameter is 7 centimetres, 2.7 inches, the labor should be at 7 months and 2 or 3 weeks.

6. If the measurement be 6 or 6.5 centimetres, 2.5 or 2.3 inches, the induction of labor should be at 7 months or not later than 7.5. These rules may be compared with the following table, given by Kormann, of the time for the induction of abortion:—

If the true conjugate—that is, the minimum or useful antero-posterior diameter of the inlet—be	2.75 to 3 centimetres	. . . .	the 20th week.
If this diameter be	4.0 "	. . . .	the 22d "
" "	4.75 "	. . . .	the 24th "
" "	5.5 "	. . . .	the 26th "
" "	6.0 to 6.5 "	. . . .	the 28th to 29th "

The other element in deciding the time, the size of the fœtus, cannot be accurately known; the uncertainty of Ahlfeld's method, for example, has been stated. We[1] may arrive at a probable conclusion from considering the size and health of the mother, for as a rule large, healthy women have large children; from the size of the father, for a large father will beget a child corresponding in size, even though the mother be small; the period in the sexual life of the woman is to be considered, for a fœtus produced in its prime will be larger than one in its beginning or in its decline; finally, an element to be considered in approximating a conclusion is whether this is a first pregnancy or been preceded by others. "The size of the fœtus, especially that of its head, and the hardness of the cranial bones increase with the number of births."

Kleinwächter directs that before operating we should know that the mother is not suffering from any acute disease, because premature birth would add a serious complication, making the prognosis unfavorable. Of course, too, we should be certain that the fœtus is living, for only such diseases of the mother as are so serious as to endanger her life—these diseases being caused by pregnancy and maintained by it—justify the induction of premature labor if the fœtus be dead.

Other indications for premature labor are uterine hemorrhage, obstinate vomiting, acute or chronic affections of the respiratory or circulatory organs, polyhydramnios, ascites, abdominal tumors, albuminuria, eclampsia, and chorea. But none of these furnish an absolute indication—indeed, many of them only exceptionally justify the operation. Great size of the fœtus and premature ossification of the cranial bones may have rendered craniotomy necessary in successive pregnancies, but it is possible that another pregnancy, in which labor is induced in the eighth or ninth month, may end in the birth of a living child. So, too, habitual death of the child in the last weeks of pregnancy may justify the induction of premature labor in a new pregnancy at a time before fœtal death occurred in previous ones.

Necessarily, in those cases where disease of the mother renders premature labor advisable, the selection of the time depends upon her condition. The longer the pregnancy can be continued, the more favorable the result for the fœtus, since every day's delay, as a rule, adds to its viability; but in some cases the condition of the mother demands the instant performance of the operation.

It should be remembered that premature labor is unnatural, it is requiring the uterus to exercise a function before it has become prepared for it, and therefore the prognosis should be guarded in all cases, and especially in those in which disease of the mother demands interruption of pregnancy, for there is added to the prostration of this malady the shock of labor. The liability to puerperal diseases is greater after premature than after mature labor.

Means for Inducing Labor.—Both dynamic and mechanical means have been used to bring on labor. Ergot was employed for this purpose by Bongiovanni in 1827, and by Ramsbotham in 1851; in recent

[1] Kleinwächter.

years the muriate of pilocarpin has been used, first by Massmann; the results are uncertain, and this remedy may be rejected. Friction of the fundus and the body of the uterus, in combination with baths and purgatives, were recommended by D'Outrepont in 1835. Hamilton and Merriman, in 1836, resorted to detachment of the ovum from the lower uterine segment by means of the fingers or of the female catheter. Irritation of the breasts by sinapisms, and the application of pumps, tamponing the vagina, and repeated douches of warm water in the vagina are other means. The injection of tar-water between the ovum and the uterine wall, to the amount of 24 ounces, was employed by Cohen in 1853. Scanzoni introduced carbonic acid into the vagina to excite uterine contractions; the result was fatal. Galvanism was employed by Schrieber in 1844, and has recently been strongly recommended by Bayer, while others advise faradism. Puncture of the membranes brings on labor within one or two days, but it is not to be recommended. Dilatation of the cervical canal seems to have been done by Rhazes and Avicenna, metallic dilators being used; Siebold, 1820, used compressed sponge for this purpose, while others have employed sea-tangle and tupelo tents, and hollow rubber cylinders or bags, which, after their introduction, are distended with water, making uniform and equal pressure. The method of Krause, 1855, consisting in the introduction of an elastic catheter or bougie between the membranes of the ovum and the uterine wall, is certain and is generally recommended. The bougie having been disinfected, and the vagina washed out with a solution of carbolic acid or of corrosive sublimate, the instrument is introduced into the uterus, the patient lying down during the operation, and subsequently remaining in bed; the bougie is introduced gently, any decided resistance to its progress being an indication to change its direction; the entire instrument is passed within the uterine cavity, and left there until the os is dilated, or nearly dilated. Following this practice, that of Charpentier, that is complete introduction of the bougie and its prolonged retention, it will not usually be necessary to assist the labor, which almost always begins within a few hours, and therefore the use of Barnes's rubber-bags may in most cases be dispensed with; but they are invaluable if it is necessary to hasten the labor, and also in case of placenta prævia where the hemorrhage is so great as to require a tampon.

Great care must be taken that the child does not perish after delivery; it may be born asphyxiated, and the means for remedying this condition must be promptly used; it may be very feeble, and it must be carefully watched during the first days that suitable artificial heat is secured it.

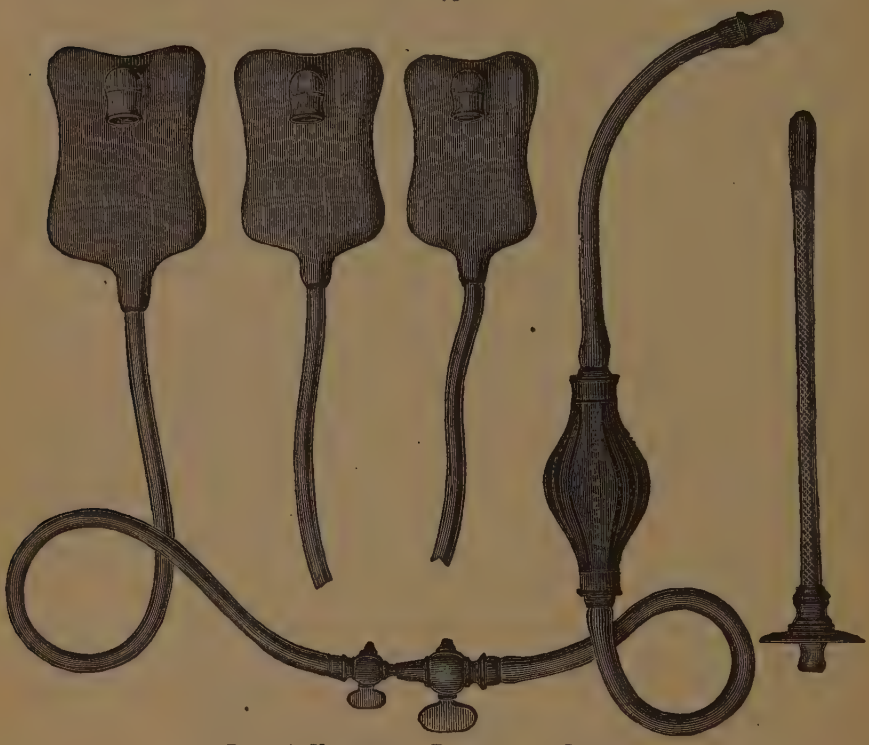
Dr. Barnes has wisely said:[1] "When we consider the many and weighty medical, legal, and moral questions involved in the arbitrary interruption of pregnancy, we shall see abundant reasons for seeking assistance in avoiding possible clinical error, and for sharing serious professional and social responsibility."

Version, or Turning.—Version is an obstetric operation by which one end of the fœtal ovoid is substituted for the other, or either for

[1] Obstetric Operations.

presentation of a shoulder. If in this operation the head be substituted for shoulder or pelvis, the version is called cephalic; but if the

FIG. 173.



BARNES'S HYDROSTATIC DILATORS AND SYRINGE.

pelvis is made to replace either of the others, it is pelvic, and when at the same time, this being more frequently the case, the operator brings down one or both feet, the version is podalic; thus it is evident that podalic is really a variety of pelvic version.

Turning the child in the uterus is one of the oldest obstetric operations, for it was known in the time of Hippocrates, whose comparison of the fœtus lying transversely to an olive similarly placed in a bottle is so well known; but the great master committed a sad error in teaching that the fœtus could not be delivered unless the head came first, an error which though some centuries afterward Celsus corrected, still ruled, sustained as it was by the great name of Galen—for who could dispute what Hippocrates and Galen taught?—until soon after the invention of printing in the fifteenth century, and then the illustrious French surgeon, Paré, established for podalic version its legitimate place. Guillemeau, the friend and pupil of Paré, advised turning by the head or by the feet in case the placenta came first. The famous Louise Bourgeois,[1]

[1] Hergott.

l'accoucheuse de Marie de Médicis—she had married an assistant of Paré, who had lived in his house for twenty years—recommended podalic version in prolapse of the cord, and also in case of uterine hemorrhage during labor, saying that it was necessary to rupture the membranes as one forces an entrance into a burning house in order to save it, and then extract the child by the feet.

Until the invention of the forceps, and the knowledge of this instrument became the property of the profession, podalic version occupied a most important place in obstetrics, and turning by the head sank into comparative neglect, for prior to possessing this instrument the accoucheur was powerless to end the labor, though he had brought the head in a favorable position.

Cephalic Version.—This variety of turning, as the most ancient, will be first described. There are two general methods by which it is performed, each being bi-manual, but in the one, one hand is external and the other internal, while in the other mode both hands are external.

A. *Version by Internal and External Manipulation.*—The great majority of cephalic versions are performed in consequence of presentation of the shoulder, and generally when the labor has been so long in progress that rectification of the unfavorable presentation is impossible by external manipulation, and therefore the method of performing cephalic version by one hand internal and the other external must be that which is most frequently employed.

There are several ways of turning by the head, and I shall first describe that of the late Dr. M. B. Wright, of Cincinnati, a method which has received scant acknowledgment even by American obstetricians, and yet it is, as those who have tried it will testify, one of the safest, simplest, and most certain. We read very often of Braxton Hicks's method, very rarely of Wright's, though the latter was published some years before the former.

The following is Dr. Wright's[1] description of this method as given in 1854: "Suppose the patient to have been placed upon her back, across the bed, and with her hips near its edge—the presentation to be the right shoulder, with the head in the left iliac fossa—the right hand to have been introduced into the vagina, and the arm, if prolapsed, having been placed as near as may be in its original position across the breast. We now apply our fingers upon the top of the shoulder, and our thumb in the opposite axilla, or on such part as will give us command of the chest, and enable us to apply a degree of lateral force. Our left hand is also applied to the abdomen of the patient, over the breech of the fœtus. Lateral pressure is made upon the shoulders in such a way as to give the body of the fœtus a curvilinear movement. At the same time, the left hand, applied as above, makes pressure so as to dislodge the breech, as it were, and move it toward the centre of the uterine cavity. The body is thus made to assume its original bent position, the points of contact with the uterus are loosened, and perhaps diminished, and the force of adhesion is in

[1] Difficult Labors and their Treatment. By M. B. Wright, M.D., of Cincinnati. For which a gold medal was awarded by the Ohio State Medical Society, Cincinnati, 1854.

a good degree overcome. Without any direct action upon the head it gradually approaches the superior strait, falls into the opening, and will, in all probability, adjust itself as a favorable vertex presentation. If not, the head may be acted upon as in deviated positions of the vertex, or it may be grasped, brought into the strait, and placed in correspondence with one of the oblique diameters." One point upon which Wright insisted as peculiar to his method was that he did not attempt to raise the shoulder, but regarded this manipulation, advised by some obstetricians, as really hindering instead of promoting cephalic version.

He directed that the entire process be done in the intervals between uterine contractions, and that when a vertex presentation was secured the practitioner should be governed as to time and manner of delivery by the general rules applicable to such presentation.

Dr. Wright first employed his method successfully in three cases in the year 1850. I believe his last published contribution explaining his method was in 1876.[1] In the twenty-six years intervening between the first application of his plan and this time he had frequent opportu-

Fig. 174.

Cephalic Version. Wright's Method.

nities of verifying its value, and often succeeded in cases where the shoulder was so impacted that others had vainly attempted podalic version. He usually operated with the patient in the position described, but in some difficult cases had her take the knee-chest position.

[1] American Practitioner, January, 1876.

Three other methods of performing cephalic version by one hand internal, and the other external, will be given, two of them antedating by many years that of Wright, while the third was not published until some years after it. 1. Busch ruptured the membranes, and immediately after passed his hand into the uterus over the occiput and to the nucha so as to exercise a gentle traction during the escape of the waters, and to fix the head in the pelvic inlet until uterine contractions occurred. Coincident with this internal manipulation the other hand was used to act upon the breech through the abdominal wall. 2. D'Outrepont with one hand introduced into the uterus lifted up the trunk of the fœtus, acting upon the presenting shoulder, and with the other through the abdominal wall pressed the head out of the iliac fossa, in which it was resting, and into the pelvic inlet. 3. Braxton Hicks[1] thus decribes his method of performing cephalic version:[2] "Introduce left hand into the vagina as in podalic version, place the right hand on the outside of the abdomen, in order to make out the position of the fœtus, and the direction of the head and feet. Should the shoulder, for instance, present, then push it with one or two fingers on the top in the direction of the feet. At the same time pressure by the outer hand should be exerted on the cephalic end of the child. This will bring down the head close to the os; then let the head be received upon the tips of the inside fingers. The head will play like a ball between the two hands, it will be under their command, and can be placed in almost any part at will. Let the head then be placed over the os, taking care to rectify any tendency to face presentation. It is as well, if the breech will not rise to the fundus readily after the hand is fairly in the os, to withdraw the hand from the vagina, and with it press up the breech from the exterior. The hand which is retaining gently the head from the outside should continue there for some little time, till the pains have insured the retention of the child in its new position by the adaptation of the uterine walls to its form."

It must be obvious that Hicks's method presents the great advantage of being available when the os is only slightly dilated, but is probably not applicable to the majority of cases to which the obstetrician is called; it is also obvious that a very essential part of the manipulation is the same as that employed by D'Outrepont.

B. *Version by External Manipulation, or External Bimanual*[3] *Version.*—Hergott states that the merit of having created this method belongs entirely to Wigand. Wigand held that version by external manœuvres was indicated whenever at the beginning of labor the presentation of the fœtus is abnormal; its purpose was to make a regular presen-

[1] Hicks's first publication upon combined external and internal version was in the Lancet, July, 1860.

[2] London Obstetrical Society's Transactions, vol. v., for the year 1863.

[3] It seems to me unfortunate that some obstetric writers substitute for this term bi-polar, for confusion may thence arise, and moreover the new designation is incorrect, for when in cephalic version by internal and external manipulation, the fingers or hand are applied to the shoulder, that is not one of the poles of the fœtal ovoid; or, again, when, as in a part of Hicks's method, just described, the head is made to "play like a ball between the two hands," those hands are not at the poles of the ovoid. There is not a step in the entire process that can be properly termed bi-polar.

tation; that is, of one or the other end of the fœtal ovoid. When Froriep advised the application of the method in the latter part of pregnancy before labor had begun, Wigand replied that he had several times done it successfully.

The time of operating should be at the beginning of labor or in the latter part of pregnancy, and the preparations are the same as those required for abdominal palpation in the diagnosis of pregnancy. A careful diagnosis of the presentation and its variety is made by palpation and by auscultation, and, also, if labor has begun, by vaginal touch. Upon turning to Fig. 135 it will be observed that the right shoulder is presenting, or would if labor had begun; the back is anterior, and the head is in the left iliac fossa. The operator is upon the woman's right side, and his right hand is placed upon the fœtal head, while the left is applied to the other end of the fœtal ovoid; the arrows indicate the direction in which the two ends of the fœtal ovoid are caused to move, the head descending to the pelvic inlet, the breech ascending to the uterine fundus; when, by the action of the hands in concert, the change in the position of the fœtus has been effected so that the head is at the inlet, Wigand's direction is followed, and she lies upon her left side, that is, upon the side toward which the head was displaced. If labor has begun, again following the direction of Wigand, the membranes are ruptured so that the head will be retained in its normal position by uterine contractions; if labor has not begun, the same object is sought by the application of a bandage; one has been devised by Pinard for this purpose, but even if a bandage is applied, it is well, for a time, for the woman to retain the side position.

Pelvic and Podalic Version.—Pelvic version by external manœuvres is indicated, according to Kleinwächter, whenever the pelvis lies nearer the inlet than the head does. It may be done during labor or in pregnancy. The manipulation is similar to that which has just been described as employed in cephalic version. But as a vertex presentation can be secured in the condition just stated with little more trouble, and as this is so much more favorable, pelvic version will rarely be employed. Some years ago in a case of shoulder presentation to which I was called as a consultant, I had the woman take the knee-chest position in order to facilitate cephalic version, the membranes being unruptured; after she had been in this position a few minutes I found that the shoulder was gliding away, and, the movement being assisted by pressure, the pelvis soon presented, when I ruptured the membranes, had her resume the recumbent posture, and a living child was soon born.

Pelvic version may also be accomplished by one hand being in the vagina, with one or two fingers introduced into the uterus, while the other hand is external. The internal fingers press to one side the presenting part, while the external hand pushes the head toward the fundus. It may be indicated in case of neglected shoulder presentation, when it is impossible to reach a foot, or, in other cases, as a step toward this end.

But immediate podalic is much more frequently employed than pelvic version. Its indications are a transverse or oblique position of the fœtus, which cannot be rectified by external manœuvres, and conditions which imperil the life of the mother, and demand immediate delivery, as may be the case in placenta prævia, certain accidents that may happen to the fœtus such as prolapse of the cord, or of one of the members,[1] in other words, when the presentation is complicated; and in certain cases where premature labor has been induced, as, for example, in pelvic narrowing. Kleinwächter regards the cases in which delivery of the child in pelvic is more favorable than in vertex presentation as very rare, and limits it to the asymmetrical, the rachitic pelvis.

The following are the conclusions given by Dr. Samuel Sloan, in regard to podalic version in cases of disproportion between the child and pelvis. They are valuable as the latest views upon this greatly controverted subject given by an able practical obstetrician:—

I. That MERE *disproportion between the child's head and the brim of the pelvis* is NEVER a sufficient reason for preferring version to the forceps as an original choice in the combined interests of mother and child.

II. That cases sometimes occur in which, *for other reasons*, version is to be preferred to the forceps as an original choice, but that if the child be of presumably average size, this operation should not be attempted with a conjugate diameter under 2¾ inches, and, with such a diameter, only if it is a *justo-major* pelvis flattened.

III. That the following are some of the "other reasons" for preferring version to the forceps as an original choice: The occiput to the wrong side of an irregularly contracted pelvis; occipito-posterior position in a generally contracted pelvis, which position cannot be rectified manually (or rather bimanually); prolapse of the funis; placenta prævia; face presentation; displacement or increase in bulk of the presenting part as by the partial or complete descent of a hand or foot along with the head; great inclination of the pelvic brim throwing the head on to the pubes instead of permitting it to be over the brim; *great* difficulty in applying the forceps, or a very tight and incomplete locking of the forceps after some difficulty in their application.

IV. That where the forceps for "other reasons" is unsuitable as an original choice, version may be tried, *not simply in the flat, but in the generally contracted pelvis also*, flexion of the head being no contra-indication.

V. That if version is decided on, the breech of the child, where this is at all practicable, should be allowed naturally to dilate the cervix; and that, if one leg must be brought down, the other should be left to increase, with the pelvis of the child, the expansion of the cervix.

VI. That if version is decided on as an original operation, it ought, if possible, to be done by the bipolar method, and as soon as the os is sufficiently dilated to permit of it—the membranes being, if practicable, kept

[1] Quite recently I assisted Dr. Flick, of this city, in a case of labor which offered the following complications: With presentation of the head there were marginal attachment of the placenta, prolapse of the cord, and descent of one hand and of a foot. The foot that presented was brought down, the head pushed up, and after some difficulty delivery of a living child accomplished.

entire after version, but ruptured at once, if this is necessary in order to keep the breech in its new position.

VII. That in cases of doubt forceps should be preferred to version, as an original choice. But should the pelvis be shallow, version has this advantage, that if the body be born, the child can sometimes be made to breathe though the head is at the brim. Craniotomy will also then be less difficult to perform, should this operation be afterwards required.

VIII. That in cases in which the forceps has failed there should be some reason for suspecting other causes than disproportion (see Prop. III.) before version is attempted as an alternative to craniotomy.

IX. That the employment of version as an alternative to craniotomy, as a routine practice, is terribly hazardous to the mother, although it probably sometimes saves the child's life.

X. That in a generally contracted flat pelvis, if the child be of average size, and the degree of contraction be at all great, version is entirely inapplicable. A *short* trial should be made with the forceps. If no progress be made, craniotomy should be performed at once.

In order that podalic version may succeed, the os uteri should be so dilated that if necessary the entire hand can be introduced into the uterus, the presenting part, for example, the shoulder not having descended so low or having become fixed that the hand cannot readily push it out of the way or pass by it, and the pelvis must be so wide that the fœtus, after turning, can readily pass through it.

The patient is placed across the bed with her hips at its edge, and her feet resting upon two separate chairs, an assistant holding each knee. As a rule, an anæsthetic should be employed. The operator, after having washed his hands and forearms in an antiseptic solution, covers the dorsal surface of the hand which is to be introduced, the wrist and the lower part of the forearm, but not the palmar surface of hand and fingers, with carbolized oil or ointment; the choice of the hand is determined by observing that when placed between pronation and supination it corresponds with the anterior plane of the fœtus. He takes the position, either sitting or standing, between the thighs of the patient, and giving his hand a conical form, the thumb resting in the palm, the index finger toward the pubic arch, the little finger at the fourchette, passes it into the vagina immediately after a uterine contraction; after the hand has cleared the vaginal entrance it is turned so that the dorsal surface rests upon the posterior vaginal wall; the conical form necessary for introduction is no longer kept, and the hand is passed up to the mouth of the womb; in case the membranes have not been ruptured this should now be done, for the practice once advised by some obstetricians not to do this until the hand has ascended so far in the womb that a foot can be felt, presents no real advantages and exposes to some dangers both immediate and remote; of course the more completely the amniotic liquor is retained the more readily version is accomplished—"it is like turning a body floating in a bucket of water"—but if the hand enters the amniotic cavity immediately after the rupture it acts as a plug and prevents the escape of any considerable amount of fluid. The search for the feet or for a foot is facilitated by the action of the free hand externally pressing upon the uterus

keeping it in one position, and especially by pushing toward the internal hand the pelvis of the child. In this search two methods have been proposed, the one known as the German, and the other as the French; in the former the hand is passed directly to the anterior plane of the fœtus and then to the part where the feet and knees are; by the other plan the hand follows the lateral plane of the fœtus until the lower limb is found, and then a finger may be hooked behind the knee, and the latter thus drawn to the mouth of the womb when the leg is extended and the foot brought into the vagina.

The objections made by Hergott to the German plan, which he admits is the more rapid, is that upon the anterior plane the four members, hands and feet, forearms and legs, arms and thighs, are situated very near each other, and sometimes crossed, so that difficulties of distinction may be presented, and the accoucheur is liable to bring down a hand instead of a foot. He also states, however, that one is often compelled to do as he can, neglecting the rules which seem the best and safest.

It is not material whether the traction be made first at the knee or directly upon the foot, nor is it important which foot or knee is secured; generally it is the one which is nearest the posterior wall of the uterus. In regard to the question of bringing down two or one limb, this may rest upon the facility of securing both, and upon the demand for instant delivery; usually it is better to bring down only one limb, for the other remaining flexed on the abdomen dilatation of the os must be greater before the pelvis passes, and hence there will be less delay in the delivery of the head, a delay which is so perilous to the life of the child; moreover, the limb which remains in position protects the umbilical cord from pressure. If two limbs are seized, the operator can only have a secure grasp by placing the index finger between them just above the ankles, while the other three fingers are placed around one, and the thumb around the other limb. When one limb is seized and brought into the vagina, a noose of thick muslin may be placed around it so as to have a secure hold by which traction can be exerted, and this traction be outside of the vagina, the latter being a point of essential importance when as in some cases of transverse presentation the head cannot be dislodged, either by external pressure or by pulling upon the foot, and the hand must be introduced into the vagina to push it up. It should be remembered that the movement given to the pelvic end of the fœtal ovoid by pulling upon one or both feet should be assisted by a corresponding movement impressed upon the cephalic end by the hand pressing on it through the abdominal wall.

If podalic version be required in shoulder presentation, when the arm has prolapsed, it is not always necessary to begin by returning the arm, but a noose should be placed upon the wrist so that it may be drawn down when the chest is delivered, preventing its ascension by the side of the head; of course when the prolapsed arm interferes with the introduction of the operator's hand, the former should be pushed up in the anterior portion of the vagina. Turning having been accomplished the delivery of the child may in most cases be left to uterine action as in an original pelvic presentation. But if traction

upon the limb or limbs be necessary, because of inefficiency of uterine action or the necessity of speedy delivery, it should be made simultaneously with the contraction of the uterus, and assisted by manual pressure upon the abdomen; in other words, the fœtal expression of Kristeller employed. The rules as to the delivery of the trunk and head, the care of the cord, and the treatment of ascension of the arm or arms have previously been given, and therefore require no further reference.

CHAPTER II.

THE FORCEPS.

THE *forceps obstetricius*, known, because of its great value, as simply the forceps—asserted by Baudelocque to be the most useful of all surgical instruments—made possible the rule given by Hippocrates, that in certain difficult labors the hands should be applied to the child's head, and delivery thus effected. The forceps gave artificial hands which could be applied without injury to the fœtal head, and rendered practicable the accomplishment of that which the unaided, unarmed human hands could not do. Yet how many centuries Medicine waited for the realization of this important idea, and how imperfect obstetric art, until the idea was made actual!

The word *forceps*, plural *forcipes*, is not derived, as some obstetric authorities have stated, from *fortiter* and *capiens*, or *capio*, that is seizing strongly, but from *formus*, warm, and *capio*, as the use of the word by Virgil and Ovid, in describing the work of the Cyclops, plainly proves, and as also shown by the employment by other writers of the term *formucales*, which Scaliger has said should be *formucapes*, as a synonym for *forcipes*.[1] Whatever the derivation, all understand by the forceps an instrument which can, with safety to both mother and child, be applied to the head of the latter, substituting a *vis a fronte* for a deficient or absent *vis a tergo*, and thus effecting delivery.

History of the Invention of the Forceps.—In the year 1569 William Chamberlen, who, it is believed, was a medical practitioner, his wife Genevieve, and their family were living in Paris; they were Huguenots, and, fleeing from religious persecution, took refuge in England. Peter Chamberlen, the son of William and Genevieve, born in Paris, was, at the time of the removal from France, probably about ten years old; he became celebrated in the profession, but his great distinction came long after death, for he was the inventor of the obstetric forceps, a fact which the researches of Dr. Aveling have clearly established, for previous to these researches the most conflicting statements were made as to which of the Chamberlens—a family which through two or three generations was represented in the profession, and no less than three of whose representatives bore the same name—the honor belonged.

The date of the invention is not known, but it probably was some time in the last of the sixteenth or the first of the seventeenth century.

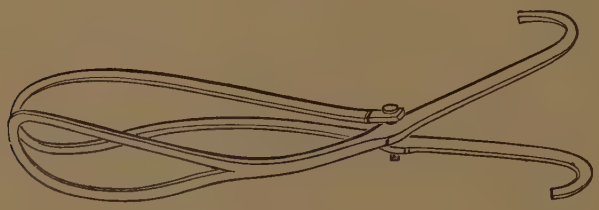
The following is a representation of what Aveling asserts is doubtless the first forceps constructed by Chamberlen. The branches cross, a characteristic of most obstetric forceps made to this day, and they

[1] See Dictionnaire Encyclopédique des Sciences Médicales, article Forceps, by Chereau.

are united by a screw. The Chamberlens had at least three other forceps, similarly made, but somewhat improved upon this model.

The invention was kept carefully concealed in the family, and used exclusively for their benefit, instead of being made known to the pro-

FIG. 175.



CHAMBERLEN'S FORCEPS.

fession. In 1670 Hugh Chamberlen, a descendant of the brother of the inventor, went to Paris, hoping to sell the forceps for "10,000 *écus*," about six thousand dollars. After spending some six months, his negotiations came to an abrupt close by his failing to deliver a woman who had such pelvic deformity that Mauriceau, then in the height of his fame as an obstetrician, declared could only be delivered by the Cæsarean operation. The latter, who we may be sure would tell the worst in regard to the conduct of this would-be rival, states that Chamberlen asserted he could deliver the poor woman in half of a quarter of an hour, but that he tried for three hours without stopping except to take breath, uselessly exhausting his strength as well as his industry, and then abandoned his efforts when he saw that the patient was likely to die on his hands. The post-mortem examination of the woman, who lived twenty-four hours after Chamberlen's attempt, showed that the uterus had been greatly injured by the instrument.

In a few days Chamberlen returned to England. In 1693 he went to Amsterdam, and was more successful in his efforts to dispose of his secret than he had been in Paris, for the famous Roonhuysen became its purchaser. The latter associated with him Ruysch and Boelkman, and the firm, with their successors, seem to have carried on for several years a successful trade in the forceps; this traffic was greatly increased by the original purchasers having a law passed forbidding any to practise obstetrics unless first examined by them, and then purchasing the secret. The baseness of those who thus trafficked in the forceps sank, as Kleinwächter says, still lower; for in some cases only part of the secret was sold, one blade of the forceps being given. Roonhuysen had a student named Van der Swam, who had been with him several years, and whom he had promised to teach the art of delivery, but had failed to make his promise good. One day this student had, by a fortunate accident, an opportunity to see the forceps without the knowledge of his preceptor. He made drawings of it, and let a friend have them; that friend communicated them to Peter Rathlaw, who, coming to Amsterdam to practise obstetrics, had been rejected by the Amsterdam examiners because he refused to buy the secret.

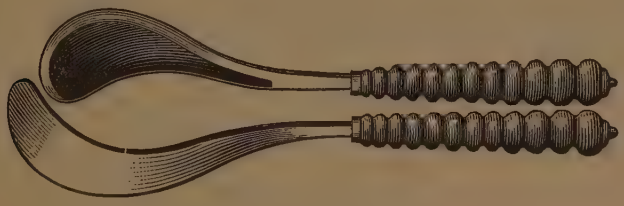
Rathlaw made good use of the knowledge acquired after his rejection, for, actuated possibly by revenge, he published a description of the forceps in 1747.

In 1716 Jean Palfyn, of Gand, who was a celebrated surgeon, presented to the Paris Academy an instrument devised by him, consisting of two parallel blades, which were to be applied, one on each side, to the fœtal head, and by which extraction was to be then made; they were known as the Palfynian hands, *Manus Palfyniana.* Different devices were used for fastening the hands together after their introduction—Heister, among others, attempted thus to make the instrument useful, but failed—nevertheless the instrument was not successful. Still it represented an idea in the construction of the obstetric forceps which a hundred years after was made practical, and which an obstetrician of the present day, Chassaignay, has sought to realize, regarding it as of great importance that the branches of the instrument should be parallel instead of crossing.

The celebrated obstetrician La Motte saw Palfyn's instrument at Paris, and declared that it was as impossible to use it successfully as it would be to pass a cable through the eye of a needle.

In 1734 Mr. Alexander Butter, surgeon in Edinburgh, published an account "of a forceps used by Mr. Dusé, who practised midwifery in Paris," stating that it was "scarce known in this country, though Mr. Chapman tells us it was long made use of by Dr. Chamberlane, who kept the form of it a secret, as Mr. Chapman also does." Nevertheless "Chapman, in 1733, published a description and plate of the instrument, which he had used from the year 1726, stating it to be the instrument used by the Chamberlens, but without stating whence he had procured it." (Churchill.) It also appears that Drinkwater, of Brentford, "surgeon and man-midwife," who began practice in 1668, and died in 1728, had similar forceps. From the time of the publication by Chapman, the Chamberlen forceps became the property of the profession.

FIG. 176.



PALFYN'S FORCEPS.

The conduct of the Chamberlens in keeping the forceps a family secret has met with general professional condemnation. Recently, however, some voices have been lifted up, if not in defence, at least in palliation of their conduct, Aveling, for example, saying that it is not fair to judge members of the profession who lived two hundred years ago by the code of ethics which medical men now accept; and Poullet

promptly adds that those who condemn the Chamberlens commit an anachronism.

Right must have some firmer foundation than the shifting sands of public opinion; "ought is an ethical atom," not merely in the fact that it is an ultimate defying analysis, but that it remains always the same; human standards of right and wrong may vary with knowledge, with conventionalities, and the prevailing sentiment of the times; nevertheless, none nor all of these can make that right which is essentially wrong. The ethical rule which governed the conduct of the Chamberlens was not found in the teaching of Hippocrates, and no one for a moment can suppose that if Sydenham or Harvey had invented the forceps, and learned its great value for the saving of human life, and the relief of human suffering, either would have kept it secret, but rather would have hastened to proclaim the instrument and its importance to the profession. The general verdict of the profession upon the conduct of the Chamberlens probably had better remain undisturbed.

Varieties of Forceps.—Kleinwächter states that at the beginning of the present century every professor thought it important that he should devise a new forceps, which, of course, when made, received his name. This ambition has not been limited to obstetric teachers, nor is it yet extinct. The profession has thus had forceps almost innumerable—some long, some short, some with narrow blades for introduction in the only partially dilated os; others with asymmetrical blades for sacro-pubic application; some of "gigantic volume," dangerous alike to the mother and the fœtus; some physicians have invented what Delore has called microscopic, or pocket forceps—mere toys, or at least capable of meeting only the most trival needs.

Undoubtedly hundreds of obstetric forceps have been devised, but, in regard to each one of the majority of these hundreds, only a single instrument has been made, and that for the inventor. In some instances the new forceps which gave fame to the inventor never existed, probably, save in the form of a drawing,[1] neverthless, drawing and description have been published of "the author's instrument."

Velpeau wisely remarked that very many of the alleged improvements in the forceps have been made by young men, who have not yet learned that in all surgical operations much less depends upon the form of the instrument than upon the skill and ability of the man.

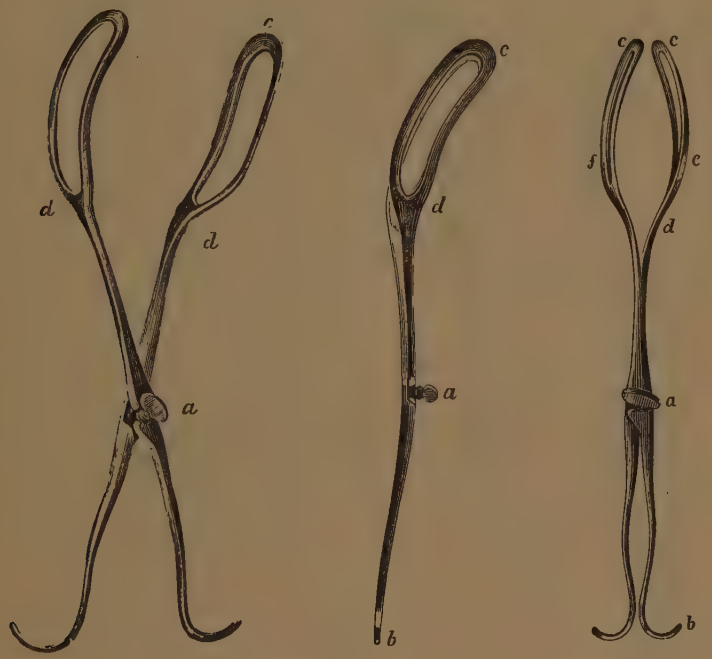
The most important improvement in the Chamberlen instrument was that made by Levret, the addition of the pelvic curve; he presented his "new curved forceps" to the Royal Academy of Surgery, Paris, in January, 1747. It was not until after 1751 that the great British obstetrician, Smellie, speaks of using the pelvic curve in his instrument. Pugh, a contemporary of Smellie, a practitioner at Chelmsford, England, published in 1754 the statement that he had invented the pelvic curve in 1740. But professional opinion cheer-

[1] The writer happens to know of a treatise on obstetrics in which the author gives a representation of his forceps, and yet the instrument never advanced beyond this primary condition; it exists only as a drawing.

fully concedes priority in the invention to Levet, because of priority of publication.

Obstetricians universally accept the advantages of the pelvic curve. Not so, however, with the next great improvement in the instrument, that of Tarnier (1877), by which traction is made in the axis of the birth canal, some regarding the axis-traction forceps—chief among them is Pajot—as no advance upon the old instrument. Some obste-

FIG. 177.



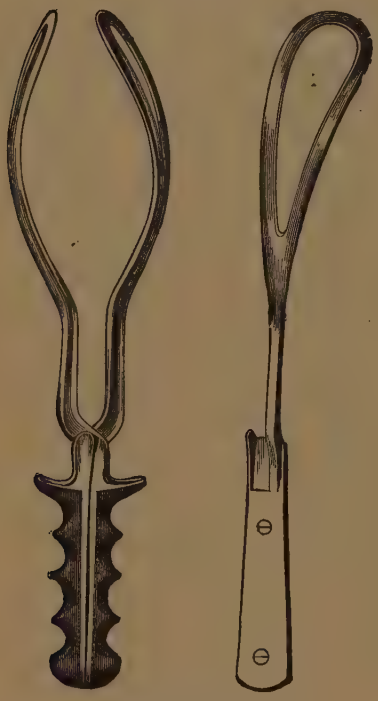
HODGE'S FORCEPS.

tricians, especially those of Lyons, have insisted upon the importance of the branches being, as in the forceps of Palfyn, parallel, instead of crossed.

Description of the Forceps.—The short, straight forceps, which never was much used in this country, and which has fewer advocates abroad, in Great Britain or Ireland, than it had even twenty years ago, will not be considered in this description, the ordinary long forceps only being referred to. This consists of two halves, known as branches or arms, these branches being distinguished as right and left. A fundamental law governing their application gives rise to these names; thus the left branch is held in the obstetrician's left hand, and introduced in the left side of the mother's pelvis, while the right branch is held in the right hand, and introduced into the right side of the pelvis—and this is the only unchangeable law in the application of the forceps. The instrument is made of steel, and the blade should have some elasticity,

but not the least flexibility; the surface should be smooth and polished, so as to be readily and thoroughly cleaned; the gutta-percha covered instruments ought to be rejected, for in spite of all care the covering will be broken, and the roughened surfaces thus left will be a most inviting lurking-place for septic poison. Each branch is divided into a handle, an articulating portion or joint, and a blade. The handle must be shorter than the blade, lest too much power of compression be given the instrument. In many forceps the handle ends externally in a blunt hook, which, in rare emergencies, may be of value, but often proves an inconvenience, and can very well be omitted. The handles should be covered upon their external side with ivory or ebony, this being grooved or notched, so that they may be firmly grasped. In some instruments, Simpson's for example, each handle has near the lock a transverse projection, or shoulder, so that two fingers can be placed over these when traction is made; a similar addition can be usefully made to the Davis forceps, and thus not only a convenient method for traction is secured, but avoidance of too great compression of the head, which might occur, at least with some forceps, when the handles are firmly grasped. In Bedford's forceps rings take the place of shoulders in Simpson's. The lock may be a fixed button or tenon upon one branch, which accurately fits into a mortise or depression in the other; or there may be a screw which, after locking, can by a few turns be made to more firmly fasten the branches together; or that which is known as the English lock, as seen in the illustration of Simpson's instrument, the one branch notched just beyond the shoulder, and into this notch a narrowed part of the other fits.

FIG. 178.



SIMPSON'S FORCEPS.

The blade is fenestrated, thus making it lighter and securing better adaptation to the fœtal head; the fenestra has somewhat the form of an elongated oval, and both the external and internal margins of the blade are bevelled. Looking at the branches when locked, it will be seen that each blade presents above a concavity, below a convexity; this curve was called by Levret the new curve, but is generally known as the pelvic curve; it adds greatly to the readiness of application of the instrument when the head is in the pelvic cavity, or at the inlet, and to the efficiency of the instrument. Another curve which all

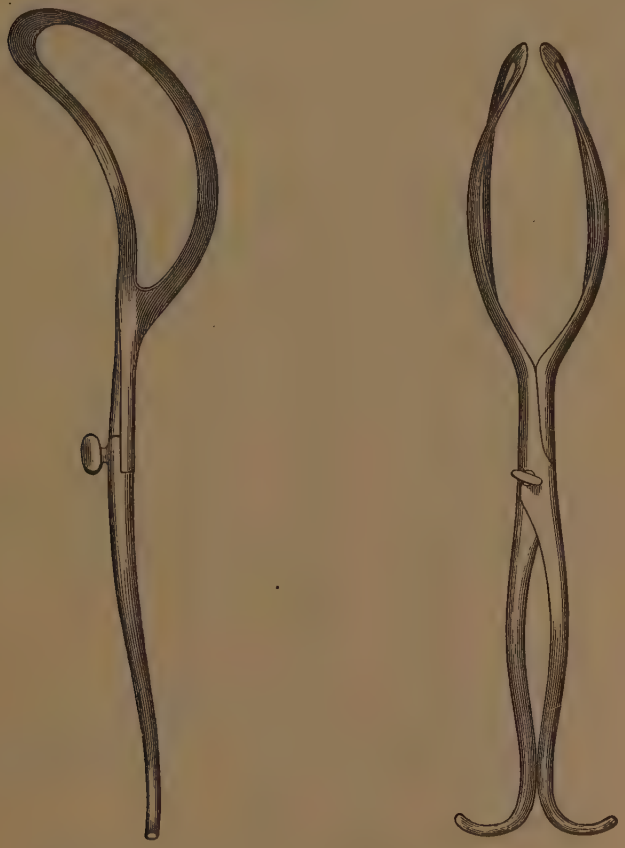
forceps have in common with that originally invented, is called the cephalic curve; each blade is concave internally, while convex exter-

FIG. 179.

THE DAVIS FORCEPS WITH SHOULDERS ON HANDLES.

nally; the blades thus fit closely upon the fœtal head, and at the same time occupy the least space. In no forceps is this curve better adapted

FIG. 180.



WALLACE'S FORCEPS.

to the sides of the fœtal head than in the Davis instrument. When the branches of the forceps are united the points of the blades should

not touch, but be at least half an inch apart; the distance between the blades themselves varies in different instruments; thus, it is three inches in Simpson's, two inches and a half in Hodge's, and two and a fourth in Davis's. It should be remembered that this measurement is made between the two opposite most distant points of the margins of the blades. Forceps vary in length, and even the same forceps varies as furnished by different makers. In illustration of the latter point, I have three of the so-called Davis forceps, procured from three different dealers; one of the instruments is less than eleven inches in length, while the second is thirteen, and the fourth is fourteen inches long; the first instrument, though procured from a leading New York house, is coarse, heavy, and does great injustice to one of the best of obstetric forceps, while the second is modelled in all essentials after the forceps used by the late Professor Meigs, weighs but ten ounces and a half, and is adequate to almost every case in which forceps delivery is advisable. The Hodge forceps is sixteen inches long, that of the late Dr. Wallace, fifteen inches; Braun's Simpson, fourteen inches; Elliot's, fifteen inches; Robertson's, thirteen inches and a half; Barnes's, fifteen inches; Pajot's forceps is forty-five centimetres, and Stoltz's forty-two, the same length as Levret's. The late Dr. Albert H. Smith in 1869

FIG. 181.

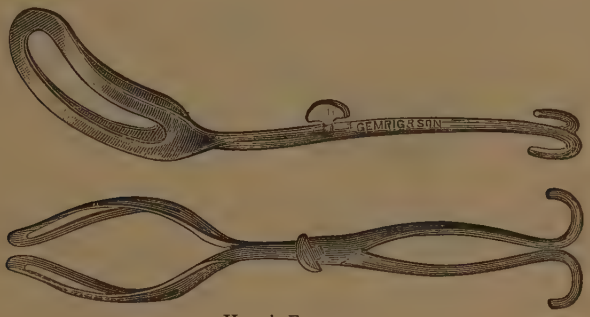
SMITH'S FORCEPS.

gave a description of his modification of the Davis instrument. "The instrument is made portable by a pivot and ratchet-joint in each handle; two sets of handles are provided, the long to be used when compression is required, and the short simply for traction." "The

whole set, taken to pieces, can be put in a leather bag nine inches in length and two and a half in width."

The forceps represented (Fig. 182) is that of Dr. Joseph Holt, of New Orleans, formerly Professor of Obstetrics in the New Orleans

Fig. 182.

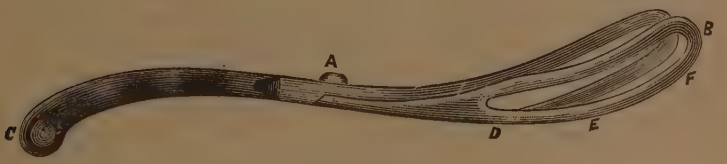


Holt's Forceps.

School of Medicine. This instrument is, I believe, used by many Southern practitioners. Its inventor presents the following claims in its behalf:—

"A minimum weight of metal compatible with full efficiency. Such a distribution of the metal as shall insure resistance and compressing power where these are especially required, elasticity where required, and all in proportion. The pelvic curvature is in actual correspondence with the curve of Carus, whereby the instrument can be applied at the superior strait, or even above the brim, as easily as at the pelvic floor. On account of this curvature the head at the brim can be pushed downward and backward in the direct axis of the superior strait as surely as it may be drawn down with a Tarnier forceps, and that, too, with all the power of which a man is capable, certainly enough for the safety of maternal and fœtal tissues. It can accomplish the work of the latter instrument without any of its complex machinery. Again, this curvature insures the points at no time pressing upon the sacrum. The bowls accurately adjust themselves to the child's head, securing uniform and general distribution of elastic pressure. The points, nearly parallel and flat, enable the blades to be passed, insinuating themselves between impacted surfaces. There is no

Fig. 183.

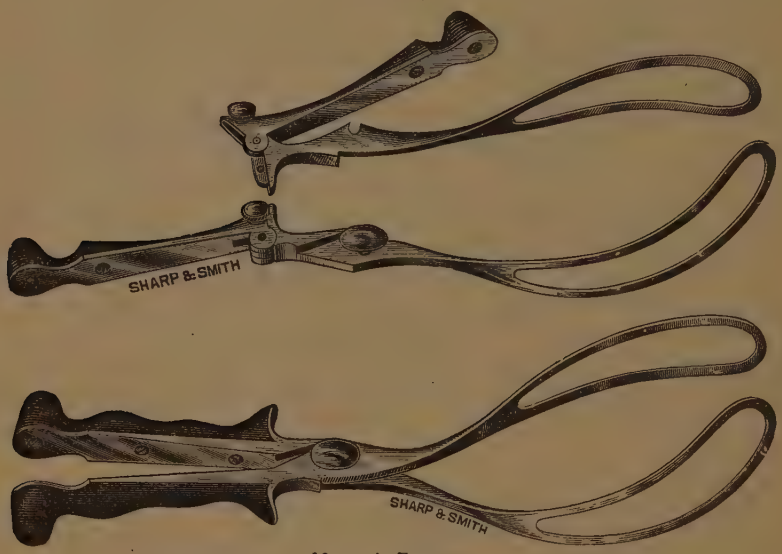


Reamy's Forceps.

degree of impaction that will not permit the instrument to be applied without force, as abundantly proved in practice. Being on, the points compress gently but never injure; this peculiar modification in the points was introduced many years ago by Dr. Warrington, of Philadelphia."

Fig. 183 is a representation of the forceps invented by Prof. T. A. Reamy of the Medical College of Ohio. The instrument is especially characterized by its strength, and by the ends of the handles being turned downward.

FIG. 184.



MILLER'S FORCEPS.

Fig. 184 represents the forceps of Professor DeLaskie Miller, of Rush Medical College. This forceps is 14¾ inches long, the width between the points of the blades ¾ of an inch, the blades are 6¾ inches long and 3 inches apart; the handles are folding, and thus the instrument made more portable.

Each of the last-mentioned instruments is used by many practitioners in the interior of the West.

Powers of the Forceps.—1. A dynamic action has been claimed for this instrument. It sometimes happens that even after the introduction of a single blade of the instrument languishing uterine contractions are quickened, or absent ones recalled, and so much importance was attached to this occasional occurrence that Kilian devised a galvanic forceps, hoping thus to increase the dynamic power of the instrument, but the experiment, of course, failed. The obstetrician, so far from seeing any quickening effect upon uterine and abdominal force resulting from the application of the forceps, may find this activity entirely ceasing, and hence no trust can be put in a dynamic action of the instrument.

2. The forceps may be used to compress the fœtal head. Experiments have proved that the diameter compressed can be reduced a little more than one-third of an inch, and that compression carried beyond this is liable to cause fractures. Moreover, when the blades are applied, as they ought always to be, if possible, to the sides of the

child's head, there is no gain in compressing any of the transverse diameters, as there is no hindrance arising from any of these being too great. Still more, if the biparietal diameter be lessened by compression, the suboccipito-bregmatic is increased, so that there is no absolute, or only slight, diminution of the head-circumference. Further, such compression hinders the moulding of the head, by which nature seeks to adapt it to the canal it must pass through; it hinders, too, the movements of the head occurring in normal labor. That a particular forceps is a powerful compressor is not a commendation, but a condemnation. In traction more or less pressure is made upon the head; according to Delore's experiments the pressure perpendicular to the axis of the head is about one-half the traction, and hence there is a relation between the force of traction and the degree of compression. Most obstetricians regard any compression beyond that which is required to prevent the instrument from slipping unnecessary, and it may be injurious.

3. The forceps as a lever. Notwithstanding able theoretical arguments by some, especially by Dr. Mathews Duncan and by the late Dr. Albert H. Smith, against the pendulum, lateral, or oscillatory movements of the forceps, most obstetricians use them in certain conditions, and this practice is indorsed by Delore and Berne. The former states, as the result of his experiments made with the dynamometer, that by slight oscillatory movements great differences are obtained, which may vary from twenty-five to sixty-five kilograms when strong tractions are used. In using the forceps as a lever, the fulcrum is on one and then on the other side of the birth-canal—or one of the hands of the operator may be placed externally upon one, then upon the other side of the vulvar margin, and thus be made the fulcrum, while the other grasps the handles—the power is at the handles, and the resistance the head, firmly held by the blades. As Spiegelberg especially enjoins, traction should always be associated with this to-and-fro movement, a movement which should be gradual, not abrupt, and not great, and should only be regarded as a supplement to the former when that is insufficient to effect delivery; if traction be not made the head simply see-saws with the lateral movements, the fulcrum on each side not advancing, but constantly remaining the same, and thus no progress is made to delivery.

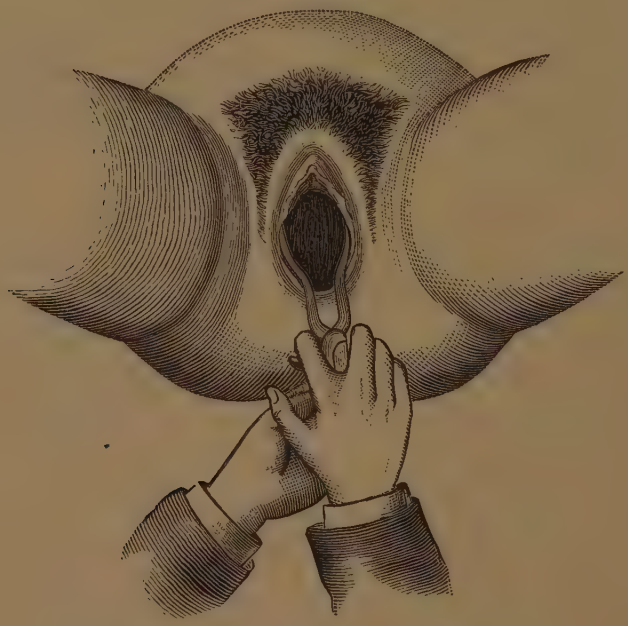
4. The forceps used to effect rotation. It not unseldom happens that in occipito-anterior positions the introduction of the posterior blade of the forceps causes the occiput to rotate in the pubic arch. In persistent occipito-posterior positions many obstetricians advocate at least the attempt to produce anterior rotation by the forceps. Kristeller describes rotation movements as "successive cyclic, horizontal, and vertical movements, with the transition movements that occur between them" (Spiegelberg).

While in the pendulum movements the fulcrum passes down in a straight line, in the rotation movements it moves spirally. Spiegelberg further states that a ring so tight upon the finger that it cannot be removed by pulling in a straight line, but can be by twisting move-

ments, or partial rotations, is an imperfect illustration of the pendulum and rotation movements. He regards rotation movements, as less efficient, and decidedly more dangerous than pendulum movements, but says that they may be useful when the position of the head is not known, as indicating the right direction for traction, and that of least resistance. This doctrine should be accepted not without hesitation, and yet, coming from such eminent authority, be rejected without just consideration. But in general the use of the forceps as a rotator is but exceptionally advisable, and frequently then the attempt is only an attempt—only an experiment.

5. The forceps as a tractor. Having thus considered the doubtful or occasional powers of the forceps, or powers that are only exceptionally required, we come finally to the essential power of the instrument, that of traction. The pulling power made by means of the forceps is to be considered in reference to the force exerted; the line of direction of the pull, and as to whether this traction should be intermittent or continuous.

FIG. 185.

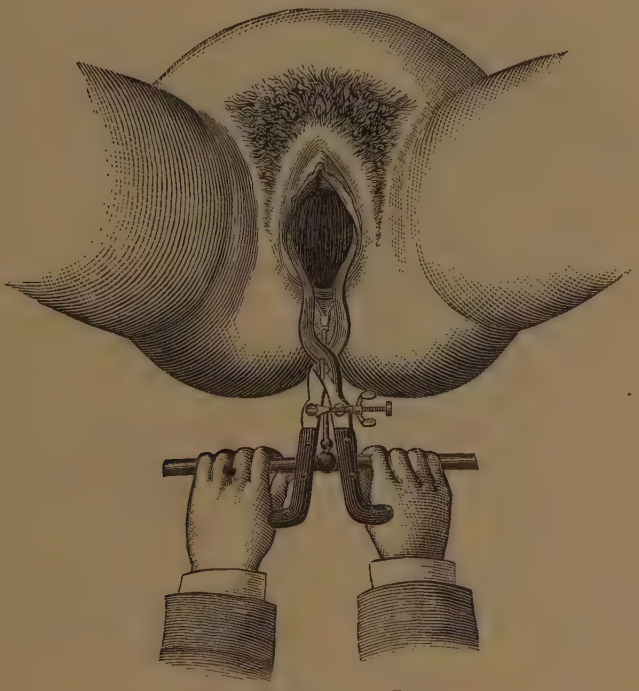


TRACTION WITH THE COMMON FORCEPS.

In easy labors the force exerted is probably, as stated by Mathews Duncan, little more than equivalent to the weight of the child; in difficult labors it is very much greater, possibly amounting to fifty pounds, and in forceps delivery it is in some cases very much greater than even the latter. Delore makes the following statement as to the force that can be used with the forceps. A man without support, that is, not

bracing himself, exerts a force equal to 88 pounds; with support, twice as much, or 176 pounds, the same as two men, but the two with support, 286 pounds. According to Tarnier, and this opinion is indorsed by Delore, it is scarcely ever necessary to use a force exceeding 132

Fig. 186.



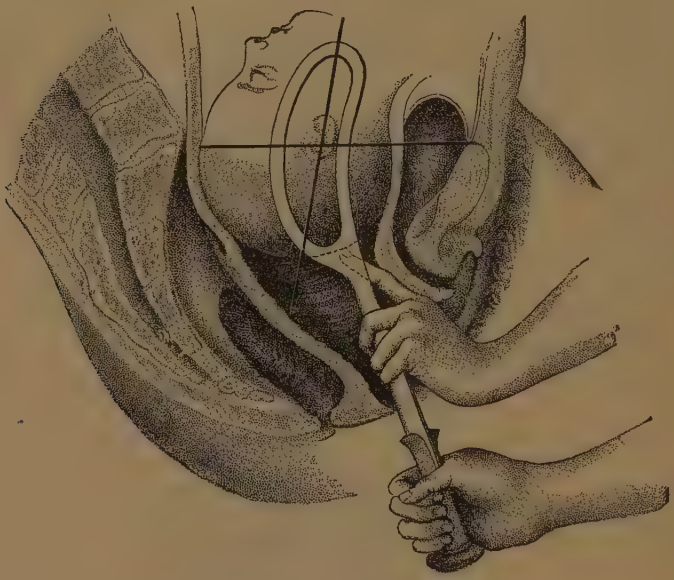
Traction with Tarnier's Forceps.

pounds; a force exceeding this is dangerous. It is very rarely that the obstetrician finds it necessary to even approximate this figure. According to Spiegelberg the pulling should be done with the forearms, while the arms rest by the sides; there is usually no necessity for extending the arms, still less for bracing the body by placing the feet against the bed.

It is universally agreed that the direction of the pull should correspond with the axis of the birth-canal. But what is that axis? Obstetricians for a time held that it was represented by the curve of Carus, and then a parabolic curve was substituted, as better showing this axis; but as the investigations, first of Fabbri, afterward of Sabatier, of Pinard, and more recently of Boissard, show the obstetric pelvis—the dynamic as distinguished from the static pelvis—the soft parts being appended to the bony pelvis, and those which make the pelvic floor, thus forming the entire pelvis—presents a cavity which is not in any respect a curved canal, but rather a cavity chiefly cylindrical, having two walls, anterior and posterior, almost vertical, and at the fundus forming a plane nearly perpendicular to these two walls.

The cylinder has its fundus at the coccyx, and an opening upon the anterior wall. Now, laying aside confusing curves, pelvic inclined planes, and speculative synclitisms, the head descends to the pelvic

FIG. 187.



SMITH'S METHOD OF EXERTING AXIS TRACTION.

floor in a straight line, then turns at almost a right angle to make its exit at the vulva; in other words, the axis of the birth-canal is at first

FIG. 188.

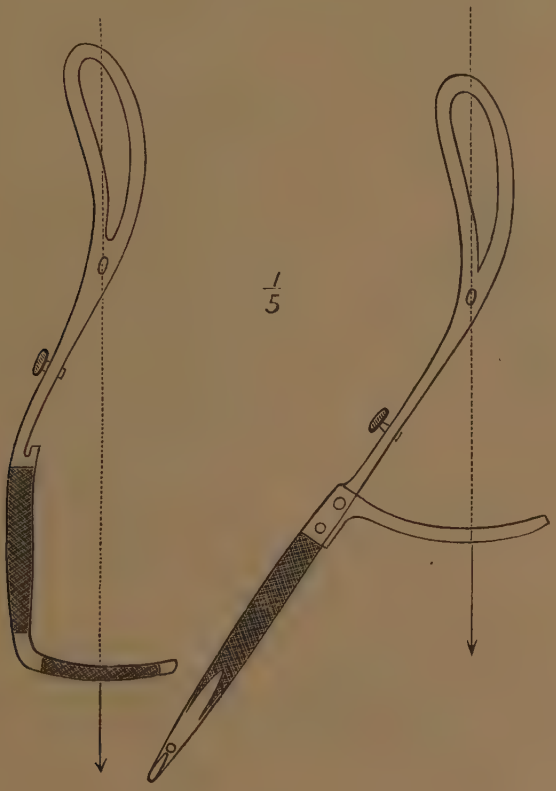
PAJOT'S MANŒUVRE.

a line directed backward and downward, and then a line almost perpendicular to it. Hence, until the head reaches the pelvic floor, the

fundus of the pelvic cylinder, the traction with the forceps must be downward and backward, and then upward and forward. When the head is high in the pelvic cavity, or is just entering the inlet, pulling downward and backward, that is, in the axis of the obstetric pelvis, is not an easy task; and yet, if it be not done, there is a great loss of power.

Now, to effect such traction, many obstetricians, since Osiander, have resorted to pressure downward at or beyond the forceps lock with one hand, while the other grasps the handles near their end, not so much for making traction as to resist the downward pressure of the other hand, and thus the handles become a lever rather than a means by which pulling is done. Fig. 187, on preceding page, is copied from an illustration published in connection with a paper by the late Dr. Albert H. Smith.

FIG. 189.



TWO FORMS OF HUBERT'S FORCEPS WITH TRACTION-ARM AT RIGHT ANGLE TO HANDLE.

Pajot's method is the following: "We apply the left hand as near as possible to the vulva, the right hand near the end of the handles; then we use sometimes these two hands in order to make the forceps, at times a lever of the first order, sometimes of the third, sometimes a

lever and a tractor at the same time, sometimes a direct tractor, according to the resistance and the height of the pelvis at which they are found."

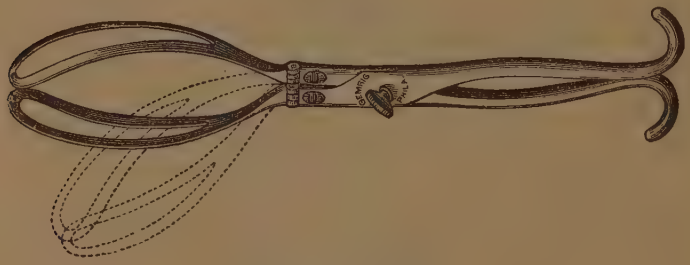
Other methods of securing axis-traction have been by certain changes of the forceps itself, or by attaching to it, at or near the blades, traction-rods. Hubert (1860) had arms projecting from the under surface of each handle of his forceps. Morales gave the handles of his instrument a perineal curve, so that in pulling on the lower portion the pull was, theoretically at least, in the axis of the pelvis. Hermann, in 1840, applied traction-rods to the forceps blades, but this invention seemed to attract no attention until after 1877, the year in which Tarnier first exhibited his own forceps with a similar device. Fig. 190 is an illustration of Tarnier's instrument, not as originally devised, but as subsequently modified.

Fig. 190.

Tarnier's Axis-Traction Forceps.

Many modifications of Tarnier's instrument have been made, among the best of which are that of Simpson and that of Lusk; other axis-traction forceps have been devised, and among those worthy of note are the instrument of McFerran, of Philadelphia, and the one of Breus. While many distinguished obstetricians have hailed the forceps of Tarnier as marking a new era in obstetrics, and as being the only important change since Levret gave

Fig. 191.



McFerran's Forceps.

the forceps the pelvic curve, others, chief among whom may be mentioned Pajot, prefer the old instrument, "the classic forceps." Tarnier's

is a much more expensive instrument, and more complicated, and probably never will supersede the old forceps, while it presents great advantages in special cases, which, however, rarely occur to the general practitioner.

The general rule, as to traction with the forceps, is that it should be intermittent—a pull, and a pause—our art thus an imitation of nature, which in normal labor expels the child by intermittent, not by continuous contractions. Nevertheless, Pinard regards slowness of traction as more important than intermittence.

CHAPTER III.

THE FORCEPS (*Continued*)—THE VECTIS.

Indications for the Use of the Forceps.—The forceps is alike the mother's and the child's instrument, and the indications for its use may be summed up as, whenever the life of either requires immediate delivery. Thus, on the part of the mother, convulsions, hemorrhage, rupture of the uterus, excessive feebleness, "threatened asphyxia from cardiac or pulmonary disease," arrest of the progress of the labor from perineal resistance; on the part of the fœtus, prolapse of the cord, complicated presentation, sudden death of the mother, feebleness of the cardiac pulsations, either associated with great slowness or frequency, showing interference with the utero-placental circulation, or compression of the cord, may be present, and demand instrumental delivery. May the obstetrician use the forceps solely for the purpose of shortening the mother's suffering? Spiegelberg admits this indication, but wisely adds that he who undertakes such "*luxus-operation*" must understand how to control his hands intellectually and mechanically; but this is not always the case, and the intended assistance is often the reverse.

Conditions necessary for the Use of the Forceps.—1. The forceps is to be applied to the head of the child; the head may be first or last, the presentation may be cranial or facial, but the rule is to apply the forceps blades only to the head.

The application of the forceps in pelvic presentation was probably first suggested by Levret, and in recent years Pajot has given this use of the instrument a qualified approval if the child be dead. But for several years some obstetricians have used the forceps in pelvic presentation when the child was living, and in some instances it has thus been safely delivered, after the means usually resorted to in delayed pelvic deliveries had been vainly tried. Among those who have in recent years recommended pelvic application of the forceps may be mentioned Frari, Tarnier, Miles, Pinard, Beluzzi, and Lusk. Frari, of Pavia, in 1847, devised a forceps for this purpose, and so have Miles, of Cincinnati, and Beluzzi, of Bologna, each constructed an instrument for a like purpose.

While probably other modes of artificial delivery in pelvic presentation will be generally selected, yet the operator, if expert with the forceps, need not hesitate to use it, after the experience of Tarnier, Lusk, and others; the best instrument, except, of course, some of those devised for the purpose, is Tarnier's, because of its unvarying compression.

2. The mouth of the womb must be completely dilated, or so far

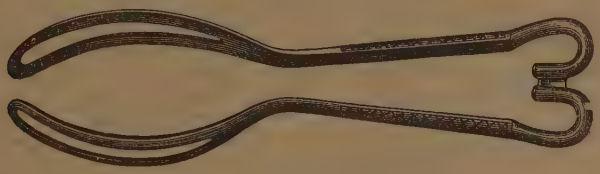
dilated and so dilatable that the blades can be readily introduced and applied, and then extraction of the head made without injury to the lower segment of the uterus; if this rule be neglected there is danger of the forceps blades tearing the neck of the womb as they are introduced, or else, when traction is made, "the lower uterine segment will be dragged down," or the tissues about the mouth of the womb be torn or seriously bruised.

Dubois devised forceps with narrow blades for introduction into the partially dilated os, but, according to Tarnier, the results were bad. Dr. Taylor, of New York, also has narrow-bladed forceps for like use in certain cases. As was stated on page 442, the late Dr. Albert H. Smith advocated in some cases—in which the first stage of labor was delayed after the evacuation of the liquor amnii, the uterine contractions being feeble—seizing the head within the uterus by the Davis forceps, but then using the instrument not for extraction, but simply to bring the presenting part down to the os, so that by the pressure of the former upon the latter more vigorous uterine action might be evoked. A few years ago some distinguished members of the Dublin school urged the early application of the forceps; one of them, Johnston, thus applied the instrument once in ten cases, but Spiegelberg has remarked that the results he obtained were decidedly more unfavorable than those which can be had by waiting. It is only when the condition of mother or of child is one of great and immediate peril that the rule given may be departed from, and these cases are quite exceptional.

3. The head must be of normal size and consistence. A small or macerated head readily slips out of the forceps blades, and these cannot be sufficiently approximated if the head be very large, as, for example, in hydrocephalus.

The advocates of forceps with parallel instead of crossed branches claim as an advantage of such instrument, that it is peculiarly adapted to large heads, grasping these with such firmness, and yet without injury, that extraction can be more readily accomplished. We present one form of the forceps with parallel blades—the forceps of Assalini.

FIG. 192.



FORCEPS OF ASSALINI.

4. The birth-canal must present no serious hinderance, either from pelvic deformity or from neoplasms, to the passage of the child. The hinderance most frequently arises from narrowing of the pelvic inlet, and the question as to whether podalic version or the application of the forceps be indicated, is one in regard to which eminent obstetric authorities differ. Certainly, if premature labor be induced, the results obtained by version give it the preference over forceps. Barnes

makes the limit in the pelvic narrowing as three inches and a fourth, which will admit of the useful application of the forceps, at the same time stating that a head slightly below the normal size, and less firmly ossified than usual, may be brought through a conjugate diameter of only three inches. Pinard holds that if the pelvis measure less than eight centimetres, the infant being at term and presenting normal ossification of the bones of the head, the forceps is not to be applied but with the greatest prudence; traction should be made gently and slowly, for the cases of exceptional success reported by different authors have naturally caused excessive tractions which could not but mutilate the fœtus, and, further, kill both mother and child.

5. Spiegelberg makes the condition positive that the head has passed the inlet by its greatest periphery, while Pajot regards it as favorable for the application of the forceps. When obstetricians speak of the head being at the superior strait or inlet, they do not mean that it is just at its entrance, but that it has so far descended that the parietal protuberances are as low as the ilio-pectineal line. The application of the forceps when the head is movable above the inlet is rejected by most obstetric authorities, podalic version being preferred, unless, as stated by Charpentier, the uterus, in consequence of the flow of the amniotic liquor, is strongly contracted upon the fœtus, rendering version impossible, and one then rightfully tries the application of the forceps. Those who are partial to Tarnier's axis-traction forceps regard it as peculiarly favorable for use when the head is high up, not having entered the pelvic inlet; Spiegelberg observes that such application when the head is high, or, perhaps, to the movable head, is not a matter of indifference for mother or for child, and must not be made to the extent that many claim. Hodge regarded "fixation of the head and its partial projection through the superior strait," as "essential prerequisites for the operation of the forceps."

Preparations for Using the Forceps.—There are but few women, suffering the agony of childbirth, who will not gladly accept means which will shorten the duration of that agony; but few, when their unborn child is in peril, who have not the maternal instinct so strong that they will cheerfully consent to the use of the forceps to avert that peril. It is unnecessary, as some obstetric authorities have recommended, to show the patient the instrument; if foolish and timorous, she will not be thereby reassured, but rather have her fear increased; while the wise and courageous are willing to trust to the word of their physician when they have confidence in him. Delore very well suggests that, if it happen that the obstetrician has not his forceps with him, it is better to send rather than to go for the instrument, lest the labor end in his absence.

If the fœtal head be low, and only the resistance of the vulvo-vaginal outlet to be overcome, the patient may be brought to the foot of the bed, the lower limbs being flexed; but if the head be in the pelvic cavity, or at the inlet, she should be placed across the bed, her hips at its edge, and each foot resting on a chair, while each knee is held by an assistant. The bladder should be artificially evacuated, if necessary, for the use of the forceps with a distended bladder may have the

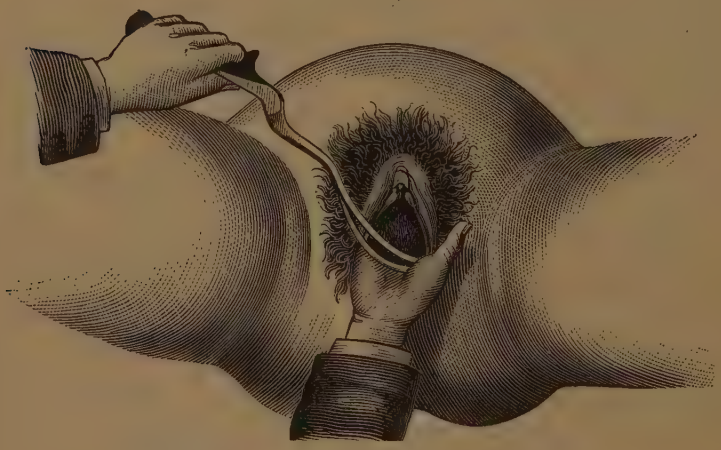
most deplorable results as far as the integrity of the vesico-vaginal wall is concerned. The use of an anæsthetic will be advisable in most cases; however, this may be left usually to the decision of the patient, it being always remembered that the anæsthesia is obstetric, not surgical. It is advisable, especially if the labor has been protracted, to thoroughly cleanse the vagina by a warm antiseptic injection, as a two per cent. solution of carbolic acid, or a solution of corrosive chloride, one part to three thousand of water. The obstetrician should have at hand hot water and other means that may be necessary if the child happen to be partially asphyxiated, and also ready his hypodermic syringe, sulphuric ether, and a liquid preparation of ergot, in case the condition of the mother after delivery should require either of the latter two to be given. He auscultates the fœtal heart, and thus knows the condition of the child; he very carefully repeats digital vaginal examination, so that he may be fully assured as to the presenting part and its position; and if any doubt remains, let him introduce his hand into the vagina, when he can, by feeling the ear of the fœtus and observing the direction of its convex border, at once know both presentation and position. He will require at least two assistants, as the nurse and the husband of the patient; but more may be needed, "according to the difficulty of the operation, or the indocility of the patient."

Operation.—This includes three acts: (1) the introduction of the blades of the forceps; (2) locking the branches; and (3) extraction. The instrument having been first made aseptic and warmed by dipping each branch into a warm solution of carbolic acid, he applies to the external surface of each blade carbolized cosmoline, vaseline, or oil, and similarly anoints the fingers of his right hand. As the locking is effected when the right branch rests upon the left, the general rule is to introduce the left blade first—"left blade, held in the left hand, and always passed in the left side of the mother's pelvis"—and accordingly this is taken in the left hand, the thumb being placed upon the inner, the fingers upon the outer surface near the lock; the grasp should be firm, secure, but gentle. The obstetrician takes a convenient position, for example, either sitting or standing between the patient's knees, if she be lying across the bed; introduces two, or if the head be high up four, fingers of the right hand into the vagina, and if possible brings their tips in contact with the margin of the mouth of the womb, and thus the fingers are made a guide to the course of the forceps blade, and a guard to the maternal parts, saving them from injury. The point of the blade is now made to enter the vulvar orifice, the handle pointing upward and to the right, the blade "sinks by its own weight into the perineo-sacral gutter," its convexity presses against the inner surface of the introduced fingers, its concavity adapts itself to the fœtal head; with the ascent of the blade, which should be assisted by gentle pressure with the left hand, and its concave surface kept in contact with the fœtal head by the fingers of the right hand, the handle moves downward and to the left, so that it becomes nearly horizontal, and in the median line. Here the question arises, should the forceps be applied simply transversely with reference to the mother's pelvis, or to

the sides of the child's head? Many British and German obstetricians hold to the former, while the general teaching of French and American is in favor of the latter. Of course, when the head is low and internal rotation has occurred, the mode of application necessarily meets both requirements; but the difference of methods comes when the head is high. The arguments in favor of placing the blades upon the sides of the child's head are, that the sides are the only parts that are symmetrical—the only parts, if labor has been in progress for some time, that lie in the same plane, and to them only are the concavities of the blades accurately adapted. The last remark applies especially to the Davis forceps, and if one prefers applying the forceps transversely in the mother's pelvis, without reference to the position of the fœtal head, he will select an instrument having a wide interval between the blades, such as that of Simpson.

Whichever method is adopted, it should be borne in mind that the blade must be introduced gently, not forcibly—gliding, feeling its way to the proper place; decided resistance to its progress proves that the direction is wrong, and therefore must be changed; the words *arte non vi*, which Blundell suggested should be engraved on one of the forcep blades, should not be forgotten in their introduction.

FIG. 193.

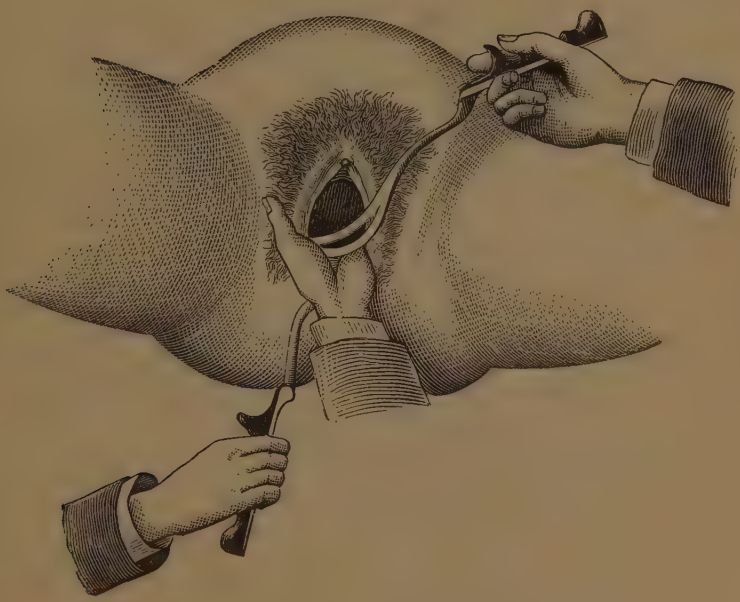


INTRODUCTION OF THE LEFT BLADE OF THE FORCEPS.

After the first blade is placed in position, its handle is given in charge of an assistant, while the obstetrician introduces the second blade. The latter takes the right branch in his right hand—right blade, held in the right hand, and introduced into the right side of the mother's pelvis—and, using the fingers of the left hand in a similar manner and for the same purpose that those of the right were used when the first blade was introduced, the second is placed on the opposite side of the child's head. When the operation is completed, the right handle rests upon the left, and they are usually locked without difficulty. Such difficulty may occur either because one blade has been introduced

farther than the other, or because the handles are not in the same plane. The difficulty in the first case is removed by pushing the one blade farther in, or slightly withdrawing the other. Where the handles are found to be in different planes, each handle is grasped by a hand, and

FIG 194.



INTRODUCTION OF RIGHT BLADE OF FORCEPS.

the operator gently rotates the blades in opposite directions; if this fail to make the handles parallel, the second blade is removed and re-introduced, and if failure still follow, both blades must be taken out, and the effort made to introduce them so that the proper relation shall be secured. If, with some difficulty in locking, it is afterward found that the handles cannot be approximated, but stand widely apart, this may result from the head being irregularly grasped, or from its being of unusual size, or from the blades not having been passed far enough over the head. In the last case it often happens that, if the handles are thus left without effort to bring them together—the blades of course being correspondingly separated—a few vigorous uterine contractions will force the head farther down in the embrace of the blades, and the difficulty is ended. Irregular seizure of the head—as, for example, that in which an oblique occipito-frontal diameter instead of the biparietal lies in the transverse diameter of the blades—is necessary in some cases; the operator recognizes this condition, and makes no effort to force the handles together, remembering the golden rule as to compression—let it only be sufficient to keep the instrument from slipping. The difficulty in approximating the handles is always great, even insuperable in case of a very large head, and it is possible that

the instrument may slip after the most careful application, when this method of delivery may have to be abandoned.

A mistake which I am sure is not infrequently made, is failure to introduce the blades far enough, and then, for example, they lie in the direction of the occipito-frontal instead of the occipito-mental diameter.

Care must be taken in the locking that hair or folds of skin of the external genital organs are not caught in the lock.

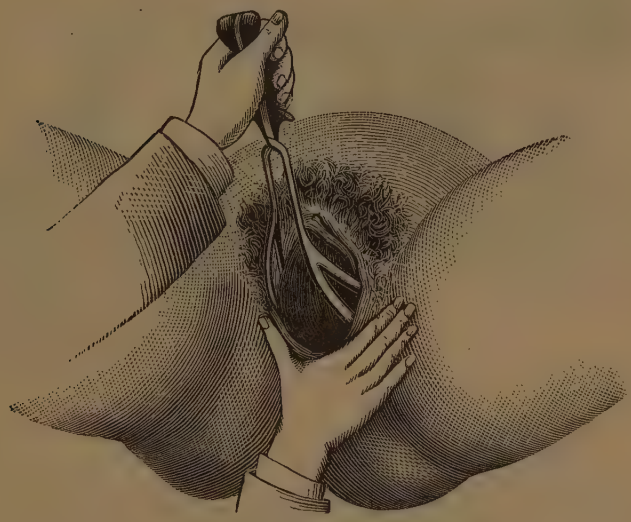
The readiness with which locking occurs, the approximation of the handles, the firmness and fixed state of the forceps, the instrument and the head making for the time being a unit, indicate that the blades are in the proper position. That these include nothing more than the head—no prolapsed cord, or projecting border of the uterus, and no vaginal fold—has been guarded against by the careful manner of their introduction; but if there be any possibility of such an accident having occurred, the sole means of resolving the doubt is to "introduce one or two fingers to the level of the blades, as well in front as behind."

The traction, as before stated, should, as a rule, be intermittent; full force must not be employed at first; it may not be necessary at all, but if required it should be reached gradually; pulling with the forearms, or with one of them at first, the arms being by the side, is a practice that has been advised. Usually if the power be given the right direction, it need not be great; but in rare instances the accoucheur has to exert considerable force—it must be his own, unassisted by that of another. In some instances the operator may find an immediate forceps delivery carrying greater danger to the mother and to the child, or both, than will a delay until nature's forces have moulded the fœtal head, thus facilitating the transmission through the birth-canal, and therefore the effort at instrumental delivery must be postponed until such moulding has occurred.

Should the forceps be removed before the head is delivered? Such removal has been strongly recommended in recent years by Freund, Goodell, Lusk, and others, and it has been made a rule of practice by Taylor, of New York, for a long time. It is the revival of an old practice. "Among the German authors, Boër, and after him Joerg, Carus, and others, have recommended removing the forceps as soon as the head is engaged in the vulva, if there is no indication for the immediate termination of the delivery" (Naegele and Grenser). Madame Lachapelle strongly advocated this plan. The object sought by the removal is to prevent injury to the perineum by thus taking away the addition to the head circumference caused by the blades of the forceps. The objections that have been made to this practice are, that while the accoucheur is removing the instrument, a violent contraction may suddenly expel the head, and he being otherwise occupied, is powerless to give any protection to the perineum; or nature's forces, on the other hand, may be unequal to the expulsion, and a reapplication of the forceps may be necessary. Moreover, we have in the forceps the best means of retarding the exit of the head until the vulvar orifice is sufficiently dilated, and at the same time of guiding it in its proper direction when that exit is made; the forceps may be so used that the perineum will suffer less injury than in natural labor.

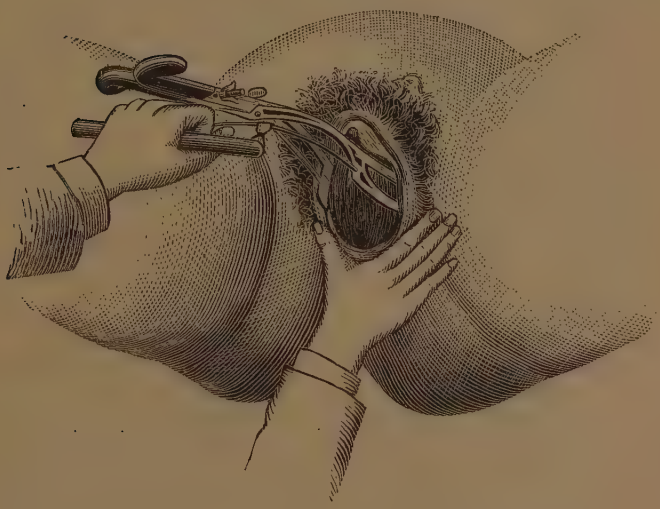
Having given this general consideration of the application of the forceps, there will now be presented the method in which the instrument is used in different presentations and positions.[1]

FIG. 195.



PROTECTING THE PERINEUM IN DELIVERY WITH THE COMMON FORCEPS.

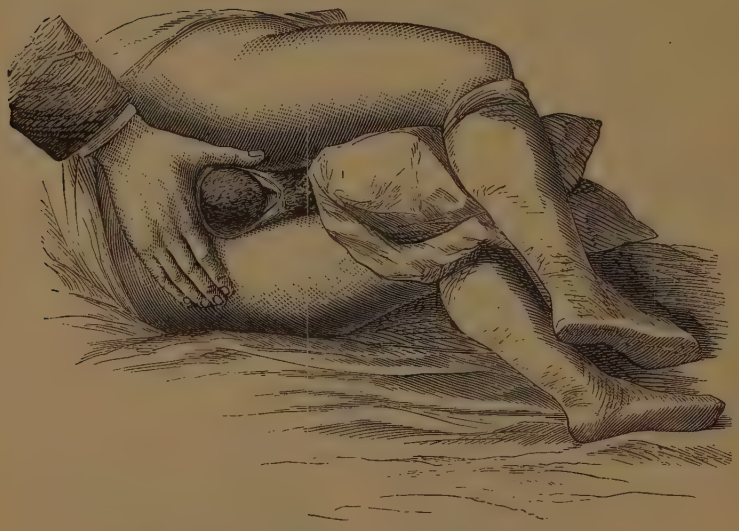
FIG. 196.



PROTECTING THE PERINEUM IN DELIVERY WITH TARNIER'S FORCEPS.

[1] In connection with these illustrations showing support of the perineum at the time of extraction, there is given an illustration of similar support in spontaneous delivery. (See p. 411.)

FIG 197.



SUPPORT OF THE PERINEUM IN SPONTANEOUS DELIVERY.

Head-first Labor.—Cranial Presentation, and (1) Occipito-pubic Position. In this position the head was so small that it entered the inlet with its occipito-frontal diameter in relation with the antero-posterior of the former, instead of with one of the obliques or the transverse; or, and this is the more frequent case, anterior rotation, instead of direct descent, has placed the occiput at the subpubic ligament, or in the pubic arch. The blades of the forceps are necessarily placed in direct relation with the sides of the mother's pelvis, and upon the sides of the child's head. In a primipara the nearer the head is to the vulvar orifice, the more difficult the introduction of the guiding fingers, but this introduction need go no farther than the parietal protuberances, for if the rim of the os uteri has cleared these it has retracted as far as the child's neck; passing the blades deeply in is unnecessary, and may do serious injury. After locking, which is easily done, the traction should be somewhat downward at first, if the occiput has not come in front of the subpubic ligament; but if it has, or after it has been brought thus in front, the handles are gradually raised so as to assist deflection, the occipital end of the long head diameter being outside the pelvis, and the normal delivery of the head taking place by a rotation upon its transverse axis through the arc of a circle, suboccipital diameters measuring the distance from the lower margin of the pubic joint to the anterior margin of the perineum. Care must be taken to observe this normal mechanism in forceps delivery. Where immediate extraction of the child is not imperative, let the head be held back until the parts are sufficiently dilated, and gradually lead it out, the nucha being made to hug the subpubic ligament. At the end of the extraction of the head, the handles of the forceps will

be near to and almost parallel with the mother's anterior abdominal wall. Only one hand is needed for the forceps, and the other should be used to note the condition of the perineum, and to protect it from being torn.

(2) Occipito-sacral Position. After the application of the forceps, the pull must be upward and somewhat forward, increasing the head-flexion, until the occiput emerges over the anterior margin of the perineum, and then the head is delivered by extension, the nucha pivoting upon the anterior border of the perineum.

Fig. 198[1] shows the great flexion of the head necessary in order to permit the occipital end to emerge from the vulvar orifice, and then the pivoting of the nucha upon the anterior margin of the perineum in complete expulsion of the head when spontaneous delivery occurs. Recognizing the normal mechanism, the operator imitates it in the artificial delivery.

Some accoucheurs, among whom Charpentier may be mentioned,

FIG. 198.

OCCIPITO-POSTERIOR DELIVERY.

always attempt anterior rotation, and it is only when this attempt fails delivery over the perineum is accepted.

(3) Left Occipito-anterior Position. Supposing the head to be in the pelvic cavity, the left blade, which is introduced first, is passed to the left side, and posteriorly, so that it corresponds with the left sacro-iliac joint; very frequently the introduction of this blade determines anterior rotation of the occiput, and then the position is simply occi-

[1] This illustration should have been placed on page 369 instead of the one found there.

pito-pubic, so that the introduction of the second blade is the same as has been described. But when this rotation does not occur, the right blade is "directed at first below, to the right and posteriorly, then brought by a very extensive spiral[1] movement to the level of the right ilio-pectineal eminence." After the blades are applied and locked, traction with anterior rotation, and delivery of the head as in occipito-pubic position follows; no attempt at rotation, however, should be made until the head has reached the pelvic floor.

Should the head be at the inlet, still the effort should be made to place the blades at the sides of the head. The simple rule given by Pinard applies in common to these, and to all oblique or diagonal positions which the head may occupy in the pelvis: Place the two blades at the two extremities of the empty oblique diameter; by such diameter is meant that in which the transverse diameters of the head are, and especially the biparietal, because this diameter does not occupy all its extent, there being always a space left between the former and the pelvis.

(4) Right Occipito-posterior Position. The introduction of the blades is done in the same way as in a left occipito-anterior position. The head is brought to the pelvic floor, then anterior rotation[2] attempted,

[1] This is known as the method of Madame Lachapelle, and has been described by her as follows: "If the branches are to be placed diagonally, that is, one behind on one side, the other in front upon the opposite side, it will suffice to pass directly the branch which ought to remain posteriorly over the sacro-sciatic ligament—nothing arrests it. The other can be easily managed, if I commence with it. Held in the hand as a pen, and leaning it across over the opposite groin, I insinuate the point of the blade in front of the sacro-sciatic ligament, then as it enters farther I lower the handle, bringing it by degrees between the thighs, until it inclines strongly below. By this movement I have made the end of the blade describe a spiral, which the fingers in the vagina direct and complete. This movement carries the blade at the same time in front and above. It is necessary to encircle the head by an oblique passage, which represents a line extending from the sacro-iliac ligament to the horizontal ramus of the pubes, and traced on the interior of the basin. The movement is effected in the twinkling of an eye, without the least pain, without the least bruising." The spiral movement is not to be employed in cases where the head has not entered the inlet.

[2] It is claimed that in natural labor anterior rotation does not occur until the head has reached the pelvic floor. This statement is too absolute, for the rotation may occur before there is the least pressure upon that floor. But in artificial rotation, as made by the forceps, no effort should be made to this end until the floor is reached by the descending head. Traction should be made simultaneously with the effort to produce rotation, and it is important, too, that the forceps should be used to keep the head well flexed. Richardson, of Boston, very ingeniously applies the forceps with the anterior and posterior pelvic curves reversed, in order to effect rotation, removing the instrument as soon as the desired change has been accomplished, and then reapplying if necessary in the normal position of the blades. Barnes holds that instrumental rotation is only exceptionally useful, more rarely necessary, and is not free from danger.

The chief objection that is made to such rotation is that if the head be moved through more than one-fourth of a circle, the body being firmly held by the contracted uterus, and therefore not able to make a corresponding movement, injury is necessarily done to the spinal cord. The experiments of Tarnier and Ribemont have proved that this opinion is erroneous, for they have shown that the torsion of the neck is distributed upon all the extent of the cervical column, and the first six or seven dorsal vertebræ. Tarnier states that exaggerated rotation exposes the spinal cord less to injury than does the great flexion necessary to be produced in order to deliver the occiput posteriorly.

Wasseige states (Des Opérations Obstétricales) that Van Huevel advised applying the new curvature of the forceps behind toward the occiput; as the blades only enter the excavation, it is, strictly speaking, possible, but, according to Wasseige, very difficult to execute, and he rejects it. The method differs only from that of Richardson, in that after rotation is effected there is no removal and reapplication.

which, if successful, requires removal, and then reapplication of the forceps; but if the attempt should fail, the occiput must be delivered over the anterior margin of the perineum.

(5 and 6) Left Occipito-posterior Position, and Right Occipito-anterior Position. The only difference in the introduction of the blades is, that in many cases it is difficult to introduce the second, right or posterior, blade after the first or left blade has been placed in position; hence, in such cases, the right blade is introduced first, but of course the handles must be crossed before they can been locked. But this difficulty may be removed by following the method of Stolz. After introducing the right blade, raise the handle and pass the left blade beneath it, and then the handles occupy their relative normal position without having to cross them after the application of the blades.

Application of the Forceps in Head-last Labors.—Where it is possible manual delivery is to be preferred. If this cannot be accomplished, then the forceps must be used, and its prompt application may save the child's life. One of three conditions may be present:—

1. The face has rotated in the sacral cavity. Here the body of the child is to be lifted up, back towards the mother's abdomen; then the blades of the forceps are to be applied to the sides of the child's head, the chin being anterior and nearest the lock; the mental end of the long head diameter passes out of the birth-canal first, and the head is delivered by flexion, the nucha pivoting on the subpubic ligament as the head is evolved.

2. The occiput has rotated posteriorly, but the head remains flexed. In order that the forceps may be used, the body must be carried backward, the child's back toward the mother's back; then the blades are applied to the sides of the head, the mental head of the long diameter being delivered first.

3. With posterior rotation of the occiput there is deflexion; the departure of the chin from the chest is so great that the occipital end of the long diameter is the lowest, and hence must be delivered first. The child's body is held in an almost vertical position, the forceps applied to the sides of the head, and first the occiput and last the face is delivered—"the disengagement is by a series of sub-mental diameters, as in a facial presentation, the sole difference being that these diameters now appear in an inverse order."

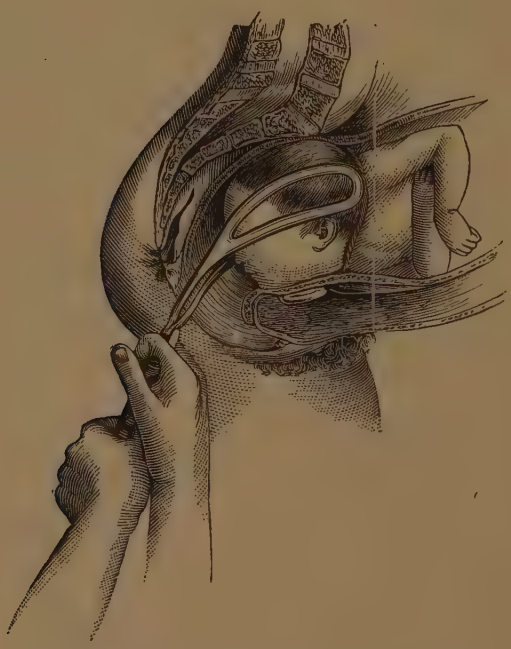
Head Movable above the Inlet.—In case the forceps is applied before the head has entered the inlet, an application which should be avoided if possible, an assistant holds the head by suitable pressure upon the lower portion of the mother's abdomen during the application of the blades. Almost invariably one blade passes over one frontal protuberance, the other over the side of the occiput obliquely opposite; thus, the first blade over the right side of the frontal bone, the second blade over the left side of the occipital bone. If the head cannot be brought into the inlet after a few vigorous efforts, some other method of delivery must be resorted to.

Head Separated from the Trunk.—It may happen, by "accident or by design," that the head has been detached from the trunk, and remains in the uterus after the latter is delivered. Removal by the for-

ceps is "delicate and difficult," and should not be resorted to unless other means, such as the use of the hand and the assistance of uterine contractions, have failed. Either make the head fixed, by pressure through the abdominal wall or by seizing the head with a hand introduced into the uterus, and apply the forceps to the sides of the head.

The Forceps in Facial Presentation.—In presentation of the face the chin must rotate anteriorly if the labor ends naturally; the chin in this movement takes the place of the occiput in vertex presentations. While anterior rotation is the rule in the latter, yet delivery is still possible by nature's unaided efforts, even should the occiput rotate posteriorly. Not so, however, as to the movement of the chin in a face presentation, for anterior rotation is essential for delivery. It should therefore be remembered that, in the application of the forceps, the instrument is valueless if such rotation cannot be effected. The difficulty and the danger of the forceps application to the head above the inlet lead obstetricians to greatly prefer conversion of a facial into a cranial presentation, or podalic version. But when descent into the pelvic cavity has occurred, and the chin is right or left

FIG. 199.



APPLICATION OF FORCEPS IN PRESENTATION OF THE FACE.

anterior, either as a primitive position, or as resulting from rotation from a transverse or a posterior position, the application of the forceps and extraction are no more difficult than in similar positions of the occiput. The same rules are followed as to the introduction and articulation of

the blades in the one case as in the other; but in facial presentations it is especially imperative that the blades be upon the sides of the child's head; departure from this rule, as, for example, applying one of the blades in the trachelo-bregmatic diameter, would give an insecure hold, and probably do irreparable mischief to the child's throat.

After the application of the forceps in a mento-anterior position, extension and rotation of the chin into the pubic arch are the movements at first to be executed, and then the delivery of the head is accomplished by flexion; "care must be taken in this last step to prevent too long compression of the vessels of the neck against the pubic joint."

In mento-posterior positions, either right or left, the mode of application of the forceps-blades does not differ from that employed in corresponding occipito-posterior positions, and therefore need not be repeated. In transverse positions, if the forceps be used, the rule as to the application of the blades to the sides of the head is necessarily

FIG. 200.

DELIVERY BY THE FORCEPS IN PRESENTATION OF THE FACE.

departed from, and an oblique application is made in which "one blade is placed upon the cheek and the base of the jaw, while the other is upon the temporo-occipital region of the opposite side."

"One ought not to apply the forceps except in case of absolute necessity, in presentation of the face; for an accouchement which may end spontaneously and favorably is sometimes arrested when its march is disturbed by untimely attempts; the operator acting rashly, if he fails in his attempts, regrets too late the resources which would have been found in prudent expectation" (Tarnier).

The changing of a face into a vertex presentation by means of the forceps has been recommended. In this proposed method the chin is directed toward one of the great sciatic foramina, where, by pushing before it the soft parts, it was thought that sufficient room might be obtained for the rotation of the occipito-mental diameter, so that descent of the occipital, with ascent of the mental, end might be obtained. This could only succeed if the pelvis were large and the head small, so that any attempt to accomplish it is but a forlorn hope.

Dr. Hodge thought that it might occasionally be practicable to deliver a living child, if the head were small and the perineum greatly relaxed, by applying the forceps, when the chin had rotated posteriorly, as accurately as possible in the direction of the occipito-frontal diameter, and drawing the head down, then causing the occipito-mental diameter to revolve between the anterior margin of the perineum and the subpubic ligament. Some cases are on record where a living child has been delivered in a direct mento-posterior position, either spontaneously or after the application of the forceps; but they are simply rare exceptions to a general law, and the rule in such positions is craniotomy.

Application of the Forceps in Presentation of the Pelvis.—If the child be dead the blades may be placed simply upon the sides of its pelvis, and firm compression made without reference to possible injury to the bones; but if it be living there ought to be interposed between the handles of the ordinary forceps, according to Pinard, something that will prevent their coming too close together, and thus avoiding injurious compression. Pinard directs the blades to be applied as far as possible, so that the pelvis may be seized by its bisiliac, or bistrochanteric diameter; nevertheless he states that he has seen Tarnier with his forceps seize the pelvis by the sacropubic diameter, the genital organs being in the fenestra of one of the blades, and extract an infant without causing any lesion. The blades ought not to pass the iliac crests, lest injury be done the abdomen. The extraction must be made slowly.

Accidents and Dangers in the Use of Forceps.—The blades may slip, the liability to this accident being greater if the head be high. "The most common cause is the bad application of the blades, and the wrong direction of the traction." Madame Lachapelle described two varieties of this accident, vertical and horizontal. The first may occur when the head is high, so that it recedes during the application of the blades, and hence is incompletely and thus insecurely grasped; or it may happen that the operator, misled by a large caput succedaneum, does not introduce the blades far enough; the handles do not readily approximate, or their points embrace one of the transverse diameters of the head. So, too, the accident may happen from the head being so small, or having so little firmness that the forceps cannot hold it. Horizontal slipping occurs when the blades imperfectly seize the head, being too far to its anterior or to its posterior surface, and it is held only by the posterior or by the anterior pelvic curvature of the instrument; this condition may be recognized by the easy approximation of

the handles. The consequences of the slipping, when vigorous tractions are made, are the sudden escape of the instrument from the pelvis, with more or less injury to the mother's soft parts and to the child, and the operator may find himself prostrate on his back. The obstetrician guards against this accident by observing whether the part of the fœtal head nearest the lock is receding, the beginning of the blades becoming visible without the handles taking the usual direction, and the blades appearing empty, while the forceps is "getting longer." The moment any indication that the blades are slipping occurs, all traction should cease, the instrument should be unlocked, and the blades passed farther in.

It has sometimes happened that one of the blades is pulled straight, the head curve being quite lost. Elliot describes this as having occurred with him in using a Simpson forceps; and I know of a recent case in which this accident happened with a Hodge forceps, the delivery of the child being very readily effected afterward by the use of McFerran's axis-traction forceps. It is probable that the accident occurs from a want of proper direction of the traction, or from too great effort to force a delivery before the head is sufficiently moulded.

Among the dangers of the forceps to the mother are prolapse of the uterus, or lacerations of the cervix; if great traction is made before the dilatation of the os, the lower uterine segment may be dragged down, torn, or seriously bruised; the vaginal vault may be penetrated by the forceps-blade, or the vagina may be torn elsewhere. Spiegelberg mentions an instance he knew, in which the anterior vaginal wall was torn from the fornix down to the lowest portion of the urethra. "Severe compression of organs contained in the pelvis may lead to inflammation ending in suppuration or gangrene, causing fistulæ, abscesses, and partial paralyses;" injuries of the external generative organs, and laceration of the perineum; fractures of the pelvis, or separation of pelvic joints; finally, a rapid forceps delivery may, if suitable care be not taken, lead to post-partum hemorrhage.

As far as the child is concerned, the "forceps may produce various lesions, from simple excoriation of tissues to fractures of bones." Charpentier states that he has seen, as a consequence of an application of the forceps by an inexperienced operator, one of the branches pushed with such violence that the blade penetrated the scalp near the occiput, passing as far as the root of the nose, detaching in its progress the skin from the cranium; the child died at the end of forty-eight hours. I have observed a similar case; the operator had passed one blade on the outside of the scalp, but the other was applied beneath the scalp, when the difficulty in making it penetrate far enough led him to ask professional assistance; fortunately the child was dead. Intracranial effusion of blood may occur, oftener, as suggested by Spiegelberg, not from the direct compression of the forceps, but indirectly from drawing the head rapidly through a narrow birth-canal. Paralysis of the facial nerve, usually on one side only, in rare cases on each side, may occur from direct pressure by the forceps-blade upon the nerve-trunk; the compression may be of one of the branches only, and then the paralysis is only of the parts supplied by it. Generally

this paralysis disappears in one or two weeks without treatment, but in some instances it lasts for years, and then may be regarded as incurable.

While the obstetrician will neither resort to the forceps "from complaisance, nor reject it from cowardice," he must be quite sure that the interests of the mother, or of the child, or of both, demand the use of the instrument, and that the conditions are present rendering that use safe.

The Vectis.—This instrument is supposed to be, like the forceps, the invention of Chamberlen. The instrument has been given different forms, according as it was used chiefly or exclusively as a lever or as a tractor; thus Roonhuysen's instrument was a plate of steel, slightly curved, but the form preferred by the few obstetricians who use the instrument is that of a fenestrated, curved blade, with a straight handle; Spiegelberg has briefly referred to it as being one blade of the forceps, and therefore an unnecessary instrument. Lowder's instrument, of which an illustration is given, is probably the best.

Hodge warmly advocated the vectis for the purpose, chiefly, of increasing flexion and assisting rotation. Wasseige, summing up the applications of the instrument, states that it seems to be especially suitable (1) to correct a cranial or facial presentation when lateral inclination prevents the engagement; (2) to bring the head through a narrow inlet, and (3) to impress upon the head different movements which it ought to take but fails to, and which cannot be caused by the use of the hand. Goodell[1] has presented a strong plea for the instrument, and, among the applications he commends, the following is especially important: "In those transverse cranial positions at the brim, due to a contraction in the conjugate diameter, whenever the blades cannot be applied to the sides or to the fronto-mastoid diameter of the head the following method, recommended by Professor Fabbri, of Bologna, will be found of signal advantage—of far greater, in fact, than the application of the forceps over the face and occiput. The tractor passed over the pubic side of the mastoid region is at first used as a lever of the first kind, the left hand on the shank representing the fulcrum and the right hand becoming the power by raising the handle toward the pubes; in other words, each hand acts in opposite directions, the left one mainly to protect the pubes from pressure. As soon as the hand is raised high enough for the blade to secure a good purchase, and also to compress the offending transverse diameter of the head, then traction is thus made: the right hand is kept at rest to become the fulcrum of a lever of the third kind, while the left acts as the power. This compound action of traction and leverage meets here several important indications. It compresses the head in its lateral diameter, flexes it,

FIG. 201.

THE VECTIS.

[1] American Practitioner, January, 1873.

and forces its pubic side to revolve around the promontory of the sacrum as the centre of motion, to glide over the smooth surface of the pubic symphysis, and to roll over into the pelvic cavity."

The same precautions should be used in applying the vectis as in introducing one of the blades of the forceps, and care must be taken, if the instrument is applied as a lever, not to injure the soft parts of the mother by using them as a fulcrum.

CHAPTER IV.

EMBRYOTOMY.

EMBRYOTOMY includes all operations employed to lessen the size of the fœtus, facilitating or rendering possible its transmission through the birth-canal. These operations embrace, therefore, perforation of the cranium and removal of its contents, cephalotripsy, cranioclasm, breaking up the base of the cranium—as by transforation, the method of Hubert, or by the basiotribe of Tarnier, or by the basilyst of Simpson—and the division of the head into sections, or lamination, decollation, evisceration, and spondylotomy. Embryotomy is one of the most ancient of obstetric operations, directions for its performance having been given by Hippocrates. All obstetricians recognize it as not only a right, but also a duty in certain circumstances, to perform embryotomy upon the dead fœtus; while a few, among whom may be mentioned Stoltz and Busey, condemn its performance when the child is alive; some, indeed, have had so strong a repugnance to directly sacrificing the life of the child that they have done it indirectly, waiting until it died before resorting to the operation, thereby in no sense evading the responsibility for its death, and at the same time this delay has added to the perils of the mother. The principle of morals upon which most obstetricians rest the right to sacrifice the child for the sake of the mother, is a very old one, and has met with general acceptance; that principle, clearly enunciated by Cicero,[1] for example, and sustained in general by moralists of all ages, is that if two lives are in such peril that both cannot be saved, but one will be by the sacrifice of the other, let that life which is of least value to the state, or to society, perish. It is unnecessary to show that the adult woman, with her various domestic and social duties, has a life of greater value than that of the unborn child; and, therefore, while the duty of the obstetrician is to save both when he can, if either is to be sacrificed let it be that of the latter—in other words, if in a given case embryotomy is a less risk to the mother than Cæsarean section, the former should be selected. This is a rule of obstetric ethics which cannot be set aside. Fortunately the brilliant successes recently had by a few operators in Germany render it highly probable that embryotomy upon the living fœtus will soon be restricted to very narrow limits.

Indications for the Performance of Embryotomy.—In general the condition requiring embryotomy is a want of proportion between the fœtus and the pelvis, or birth-canal. The disproportion, as far as the fœtus

[1] "Quid, si in una tabula sint duo naufragi, hique sapientes, sibine utervis rapiat, an alter cedat alteri? Cedat vero; sed ei, cuius magis intersit vel sua, vel reipublicæ causa, vivere. Quid, si haec paria in utroque? Nullum erit certamen, sed, quasi sorte aut micando victus, alteri cedat alter." (Cicero de Officiis, Book III., xxiii. Pereya's ed.)

is concerned, may arise from its excessive development, advanced ossification of the cranial bones, or from pathological increase in size—as, for example, hydrocephalus—or from failure in the normal mechanism of labor, *e. g.*, in a face presentation the chin may not rotate into the pubic arch, or it may turn into the sacral cavity; the shoulder may present and turning be impossible, because of impaction.

Garrigues,[1] in a recent paper, states that since "the introduction of the bichloride and occlusion-dressing treatment" he has three times performed craniotomy on the presenting head, once of a dead and twice of a living child. He further remarks: "Of the two mothers whose children were living one was a young, splendidly built primipara, with an excellent constitution, enjoying blooming health, and most happily married. All the trouble came from an enormous child with too advanced ossification. Following the golden rule to do to others as I would have others do to myself, I would not for a moment entertain the idea of proposing to a husband under such circumstances to submit his wife to even the most perfect of all Cæsarean sections."

Disproportion may arise solely from the condition of the mother's pelvis—it may be narrowed or encroached upon by tumors either originating from it or from neighboring organs—or some part of the birth-canal may be narrowed by neoplasms or by cicatrices.

The most frequent of these conditions rendering craniotomy necessary is narrowing of the pelvis; it is important, therefore, to have at least an approximative rule in regard to the degree of narrowing which justifies this operation. Kormann describes as perforation pelves those in which there is general contraction, with the true conjugate between 8-6.5 centimetres, and the flat pelvis when this diameter is between 6.5–5 centimetres, and conditionally, also, 4 centimetres. He further states that when the mother greatly desires a living child, one may regard the perforation pelvis as a relative Cæsarean section pelvis.

In regard to the relative indication for the Cæsarean operation, the following statements of Carl Braun,[2] quoted by Jaggard, are of importance:—

Cæsarean section on the living woman, for the preservation of the living fœtus in pelvic deformity—in which the child, dead and diminished in volume, can be extracted through the pelvic canal, and the health of the mother can with probability be preserved by the perforation of the child's head—is not permissible under the following conditions:—

a. When the parturient woman, in full consciousness and without any direct coercion, declines Cæsarean section.

b. When the parturient woman is rendered unconscious by disease (eclampsia, meningitis, apoplexy, etc.), by medicines (chloroform, ether), by poisons, or intoxicating drinks.

c. When the child's life has been imperilled by uterine contractions, attempts at version, or the forceps, or when the child is deformed or not viable.

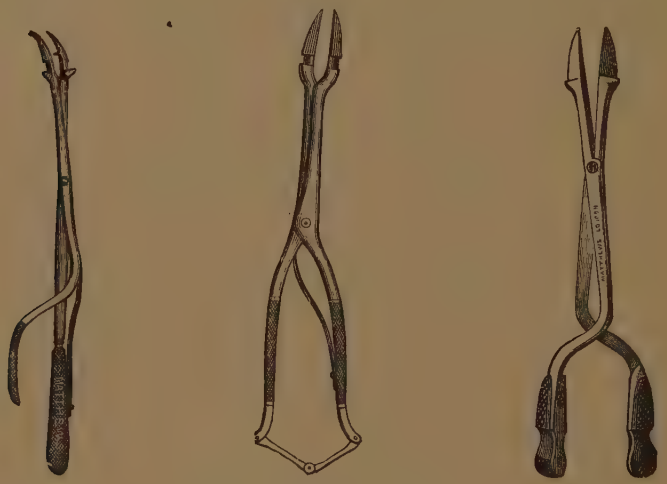
[1] American Journal of Obstetrics, October, 1886.

[2] Ibid., 1884. Dr. Jaggard has presented a strong argument in favor of craniotomy upon the living fœtus as a justifiable operation, in reply to an able paper by Dr. Busey, published in a previous number of the same journal, condemning the operation.

For a series of years not a single parturient woman in the Vienna Lying-in Hospital has determined to submit to Cæsarean section upon the ground of the relative indication.

Perforation.—Craniotomy may be necessary in a vertex, or in a face presentation, or when the head comes last, and the first step is perforation of the cranium. In order that this may be done readily and safely, the head, if movable, must be held by an aid, who presses upon it through the abdominal wall with his hand. Carus was the first to apply forceps in order to secure this immobility, a practice in which many have imitated him. The instrument selected for perforation is Smellie's scissors, or some modification of it.

FIG. 202. FIG. 203. FIG. 204.



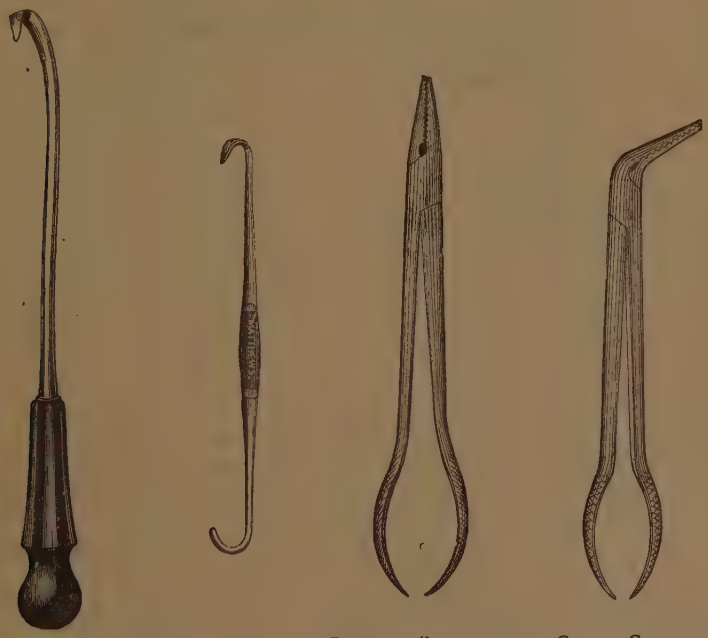
VARIOUS FORMS OF PERFORATORS.

Fritsch justly condemns all trephine perforators—those of Kiwisch-Leissnig and of Braun, among others—because of the difficulty in thoroughly cleaning them; for in order that this can be properly done they must be returned to the instrument-maker each time after they are used: Thomas's perforator should be rejected for the same reason. The patient occupies the position advised for the application of the forceps; anæsthesia is usually unnecessary. The operator, after the vagina has been washed out with an antiseptic solution, and the hands and instrument have been made aseptic, introduces two fingers of the left hand into the vagina and brings their tips in contact with the fœtal head; the scissors, now held with the right hand, have the blades guided along the palmar surface of the fingers in the vagina until their points are brought in contact with the fœtal skull and placed perpendicular to the bony surface. It is better to perforate bone than to enter through a suture or a fontanelle, for then the opening is more likely to remain patent instead of being closed by the approximation of the fœtal bones under compression. The

next step is, while carefully guarding the instrument from slipping, by a boring movement to make its points penetrate through the bone; when this is accomplished the blades are caused to enter as far as the shoulders of the instrument, then opened so as to divide the bone, and after this closed, given a quarter rotation and again opened, so that an incision perpendicular to the first one is made. The next step is to thrust the scissors deep in the cranial cavity, move the blades in different directions, so as to thoroughly break up the brain substance, including the medulla oblongata—if, by misfortune, it has been necessary to operate upon the living fœtus—for more than once after a craniotomy, when this precaution was not taken, the child has been born alive and even lived for some days in a horribly mutilated condition, greatly to the distress of the family, if not to the disgrace of the obstetrician.

If necessary to completely evacuate the contents of the cranium, the nozzle of a syringe may be introduced into the artificial opening and a stream of warm water thrown in. The extraction of the fœtus may now be effected in many cases by the crotchet, an instrument which, if carefully used, does not deserve the reproaches that have been cast upon it (Figs. 205 and 206). Of course, if the practitioner has at

FIG. 205. FIG. 206. FIG. 207. FIG. 208.



CROTCHETS. STRAIGHT CRANIOTOMY FORCEPS. CURVED CRANIOTOMY FORCEPS.

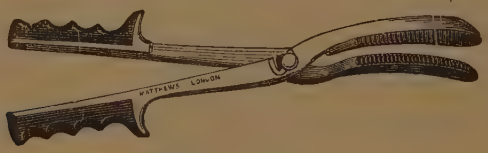
hand a cranioclast or a cephalotribe, delivery can generally be more promptly accomplished with either than with the crotchet; but with most practitioners the last is more available than the other instru-

ments. In order to prevent the injury that may be done the mother's soft parts by the crotchet slipping a guarded instrument has been invented, but it will prove a most inefficient one for traction; it is guarded alike from doing any good as well as any harm. The hook-like end of the instrument is introduced into the fœtal skull, a firm hold secured, and two fingers placed upon the outside of the head, directly opposite the point where the instrument has caught, so as to prevent its slipping, or if it does, to guard the vagina from harm; if slipping occur, another part of the fœtal head should be sought and a firmer hold secured. Care must be taken not to tear the fœtal scalp, for this protects the mother's parts from being injured by the otherwise exposed edges of bones or of their fragments.

In some cases it may be necessary to further diminish the size of the head, after perforation, before attempting extraction with the crotchet; and this may be done by various instruments, such as Meigs's craniotomy forceps (Figs. 207 and 208).

Cranioclasm.—In most cases the cranioclast is one of the most efficient instruments not only for breaking up the bones of the skull, but also for extraction (Fig. 209). The cranioclast is the invention of

FIG. 209.



SIMPSON'S CRANIOCLAST.

the late Sir James Simpson. It is composed of two separate blades, fastened by a button joint, one for introduction within, the other to be applied without the skull; when applied and locked the concavity of the external blade fits upon a convexity of the internal one, a portion of the fœtal skull being firmly included between the two. The cranioclast as now made includes a transverse arm connecting the ends of the handles; this arm is a screw, and a nut after its application causes the handles to be brought closer together and makes them immovable, so that a firmer and fixed grasp is secured for the blades when applied to the fœtal head.

Cephalotripsy.—The cephalotribe, devised by the younger Baudelocque (nephew of the great obstetrician) in 1829, consists of two strong forceps branches, in some instruments straight, but in others having the pelvic curvature of forceps; the blades are very narrow, so as to admit of their introduction into a contracted pelvis, and in most instruments solid, but in Bailly's and in some others fenestrated —a single fenestra in each blade in some, but in others, as Tarnier's, three. The instrument is provided with a transverse bar made as a screw and applied to the ends of the handles (Figs. 210 and 211). The blades are applied to the sides of the fœtal head, which is then compressed by means of the powerful screw at the handles. Perforation ought always to precede the application of the cephalotribe,

but it is unnecessary to wash out the cranial cavity, for the strong pressure to which the head is subjected will force out the contents. In almost all cases where the cephalotribe is necessary there is such narrowing of the inlet that the head is in a transverse direc-

FIG. 210.

HICK'S CEPHALOTRIBE.

FIG. 211.

FŒTAL HEAD CRUSHED BY THE CEPHALOTRIBE.

tion, and the blades of the instrument seize it in the direction of the suboccipito-frontal diameter. But as it is important to break up the base of the cranium, Wasseige[1] advises when one cannot seize the head by the biparietal diameter, to diagonalize it, as far as possible, before the application of the instrument—"that is, we bring the head anterior and then apply the instrument in the oblique pelvic diameters: these applications can be made where the pelvic narrowing is between 5.5 centimetres and 7.5 centimetres—that is, between 2.1 and 2.7 inches—while below the former oblique applications are impossible."

After the crushing, which must be done slowly, one or two fingers should be introduced to ascertain that the part of the head which has

[1] Op. cit.

been widened in opposition to that which is narrowed lies in the longest pelvic diameter, and that no spiculæ of bone are exposed which will tear the mother's soft parts in the extraction of the head, and if these are found, the fingers should be retained in the vagina to protect it from injury during the operation. To bring the long diameter of the fœtal head in correspondence with that of the pelvis, a quarter rotation of the instrument, still of course retaining the head in its grasp, is made, and then traction exerted as in forceps delivery. In some instances before the latter can be effected, it is necessary to remove it, especially if the instrument slip, and apply it in another direction so as to more completely crush the skull. If extraction remains impossible after repeated crushings, some operators advise waiting a few hours until uterine contractions have so moulded the head that its transmission becomes possible.

Lamination.—This name is given to the process of dividing the head into two or more segments. The first method is that of Van Huevel; in 1842 he devised his forceps-saw, and successfully applied it in 1844. The fundamental idea is the section of the cranium by a saw acting from below above between the blades of a forceps, and dividing the head, more especially the base of the cranium, into two portions. Other varieties of the forceps-saw have since been invented.

The expense of the instrument and its somewhat complicated character will prevent its general use in craniotomy. Barnes says that it is difficult or impossible to apply when the conjugate is reduced to 2 inches, or even to 2.5; Wasseige, however, states that the instrument can be used when the conjugate is only 30 millimetres, 2.1 inches.

Barnes, 1869, showed that section of the fœtal head could be made with the wire écraseur, and this simple method is to be preferred.

Breaking the Base of the Fœtal Head.—Various instruments have been proposed for this purpose, but only three will be mentioned: the *transforateur* of Hubert, devised in 1860; the basylist of Simpson; and the basiotribe of Tarnier. The first consists of a firm rod of steel, terminating at one end in a transverse handle, and at the other in a pear-shaped screw with a sharp stiletto-like point, and of a protecting branch which is attached to the rod; it is shaped like the forceps blade, and has a conical opening in its lower end to receive the point of the perforator. This point, covered with wax, or concealed by the finger of a rubber glove, when introduced, is made to penetrate the cranial vault, either through a bone, a suture, or a fontanelle, and then by movements of rotation the opening is gradually enlarged until the entire pear-shaped portion enters; the next step is by free movements of the instrument to break up the cerebral tissue. After this the point is guided to the occipital foramen, and when this is found, the former should be directed toward the chin, and when at a distance of 4 or 5 centimetres, 1.5 to 1.9 inches, in front of the foramen the *sella turcica* is reached, which is then perforated by means of rotary movements, and the protecting branch is applied just opposite upon the fœtal head. The basylist of Alexander R. Simpson, which Wasseige states is only a modification of the *diatripteur* of Didot, was presented to the Edinburgh Obstetrical Society, January, 1880, and an improvement of it

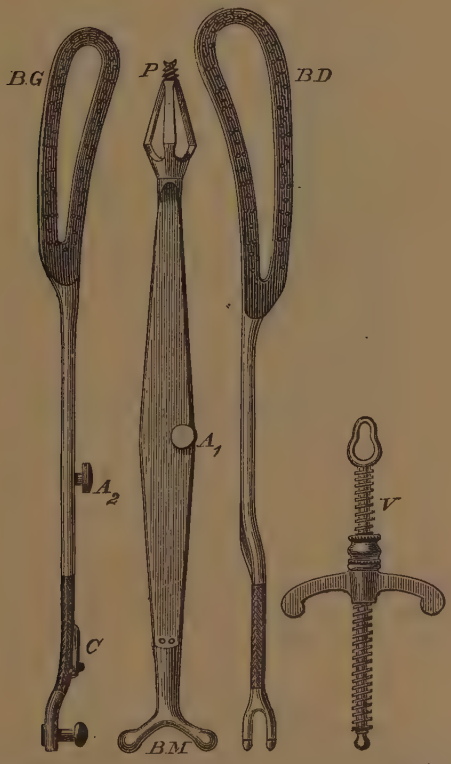
January, 1883, when the inventor reported a case where basilysis was successfully employed in dystocia from hypertrophic elongation of the cervix (Fig. 212).

FIG. 212.

SIMPSON'S BASILYST.

The instrument has also been successfully used to directly break the base of the skull in narrowing of the pelvis; in one instance the transverse diameter of the base was reduced from 3 to 2 inches. Whether, as Simpson has said, basilysis is the operation of the future or not, he certainly has invented a simple and ingenious instrument for accom-

FIG. 213.

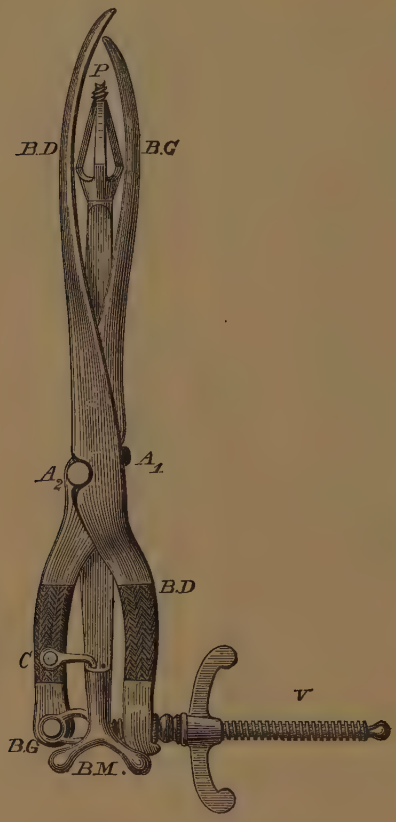


TARNIER'S BASIOTRIBE.—The instrument is composed of four pieces: 1st, the left blade, *BG*; 2d, the middle blade, or perforator, *BM*; 3d, the right blade, *BD*; 4th, the compressing screw, *VA* and A_2, show the locks, *C* is the catch to unite the left blade to the middle blade.

plishing it. The basiotribe of Tarnier was presented to the Paris Academy of Medicine, December, 1883. It combines an excellent

perforator of the cranial vault and a cranioclast; it does not break the base of the head, as do the instruments of Hubert and Simpson, by penetrating it, but by crushing. Figure 213 represents the several parts of which the basiotribe is composed, while Fig. 214 shows them united.

FIG. 214.



TARNIER'S BASIOTRIBE; THE PARTS UNITED.

In operating the perforator is made to penetrate the cranial vault, after which the left or short blade of the instrument is introduced, and fastened by the catch, C, and then the right or long blade; the screw is then fastened to the ends of the handles, and turned until sufficient crushing is effected.

Perforation in Presentation of the Face.—This is more difficult than perforation in vertex presentation; it may be done through the palatine vault, through one of the orbits, or through the frontal bone, the last being preferred.

Perforation in Head-last Labor.—An assistant holds the body of the child out of the way, and the operator perforates the head at one of the posterior lateral fontanelles. Chailly advised that the opening be made through the palatine vault, condemning acting either upon the

forehead or the occiput, because the point of the perforating scissors could not be directed perpendicularly, but must be placed obliquely to either bony surface, and hence were liable to slip, injuring the mother.

In concluding the subject of craniotomy it is to be remarked that the student should not think it a very simple and easy operation that can be quickly performed and delivery promptly effected. This is true in some cases only, but in many difficulties attend almost every step in the process, and the delivery may not be accomplished for hours. Therefore the operation is not to be undertaken unless the proof be clear that it furnishes the best chance for the mother, and on the other hand, not delayed until her powers are so exhausted that she is liable to perish before or after its accomplishment.

Decollation or Decapitation.—In case of shoulder presentation, when turning is impossible from the condition of the uterus, or from the presenting part being wedged in the pelvis, it is necessary in most cases to divide the neck. This operation can be very quickly done by means of a piece of strong twine which is thrown around the neck, then used as a saw, to-and-fro movements given it, burying it deeper in the cervical tissues, until finally the section is completed. If this method is impossible from the difficulty of placing the twine, that of Dubois may be employed. Pull down the shoulder by means of the prolapsed arm, so that a blunt hook may be applied over the neck, then drawing the latter as far down as possible, divide it by means of a long and strong blunt-pointed scissors. After division of the neck delivery of the body is readily effected in most cases; that of the head may present greater difficulty, but can be accomplished by the blunt hook in some cases, and in others by the cephalotribe.

Spondylotomy.—This is the name given to division of the vertebral column at some other point than the neck. It may be done with the scissors of Dubois.

Evisceration.—This is chiefly resorted to in those cases where in an impacted shoulder presentation the neck is inaccessible. Again, the scissors of Dubois, or a similar instrument, will be the most useful in opening the chest; after the contents are in part removed, an effort is made to deliver the fœtus, of course doubled upon itself, by the crotchet, or the blunt hook.

CHAPTER V.

THE CÆSAREAN OPERATION AND ITS SUBSTITUTES.

By the Cæsarean section or operation is meant opening the abdomen and the uterus, and the extraction through this way of the fœtus when delivery is impossible through the birth-canal. The name has no connection with Cæsar, but is derived from the operation itself, *cæso matris utero.*

The operation performed after death is a very ancient one, having been established by the Romans as a law centuries before the Christian era, its purpose being to secure citizens to the State. The Christian Church strongly enjoined the operation, even when the mother's death occurred quite early in pregnancy. The first known operation upon the living subject was by Jacob Nuffer,[1] a sow-gelder, in 1500, the patient being his wife; she recovered, and afterward bore several living children. Kleinwächter states that the next operations were by Döring, 1531, and by Donat in 1549, and that the first operation in Germany was by Trautmann, in Wittenberg, in the year 1610.

Terms designating the Cæsarean Operation and its Chief Substitutes.—The term laparotomy[2] has been strangely perverted from its etymological and original meaning, and applied as part of a compound word to the Cæsarean operation, to that of Porro, and to that known by the name of Thomas. It will be better, while protesting against this great perversion, to replace the various compounds of laparotomy by correct terms, and thus the Cæsarean operation will be called gastro-hysterotomy; gastro-hysterectomy is the proper designation for Porro's operation, and gastro-elytrotomy, the name used by Baudelocque, is the appropriate one for the operation commonly called laparo-elytrotomy.

Indications for Gastro-hysterotomy.—These have been divided by Naegele and Grenser into absolute and relative. When there is such

[1] The earliest history of this operation which I have had the opportunity of reading is given by Scultetus in his Armamentarium Chirurgicum, Frankfort, 1666. We have the picture of a woman at the end of her first pregnancy some days in labor without relief from nature's efforts, or from the assistance of "thirteen midwives and several lithotomists." The husband, despairing of help from these means, suggests others to his wife, and she consents. Next he procured a license from the civil authority, and returning home first addresses the midwives, exhorting them to be brave, but advising the timid to retire, and as a consequence eleven withdrew, only two remaining to assist him; the lithotomists also remained. He places his wife upon the table, implores Divine help, and then incises the abdomen *non secus ac alicui porco.* Almost immediately after the incision has been made a living child was extracted uninjured, and the woman made a rapid recovery.

[2] Laparotomie (from λαπάρα, flank, and τομή, section). Operation for lumbar hernia or for artificial anus, practised in the lumbar regions. Littré and Robin's Dictionary of Medicine, Surgery, etc.

obstruction of the birth-canal, whether arising from uterine tumors or tumors of adjacent organs, or of the pelvis, or from conditions of the cervix or of the vagina, or from pelvic contraction that even a mutilated fœtus cannot be delivered through the natural passage—the operation should be done.

While delivery has been effected by craniotomy when the antero-posterior diameter of the inlet was only two inches—and, indeed, when it was only one and a half inches—the risk of the woman in the hands of most practitioners will be less from a timely gastro-hysterotomy than from embryotomy, and hence the former is indicated. But now let us take those cases where this diameter is from two to three inches; the indication is relative, and the woman must have the right to choose for herself. As Naegele has said, when the indication is only relative and the mother, in sound mind and after mature reflection, positively refuses to submit to the Cæsarean operation, it would be an unjustifiable cruelty to compel her to undergo it; but whenever the practitioner is satisfied in a given case that gastro-hysterotomy is no more dangerous for the mother than embryotomy, the former operation ought to be advised and urged. This is a simple, plain rule to guide him, and is better than any sentimental appeals.[1] And, on the other hand, if the destruction of the life of the child furnishes the best security for that of the mother, there is no room for hesitation unless she elects the opposite course. Yet the wonderful improvements that have been made in the Cæsarean operation render it probable that embryotomy will be rarely necessary, even if the carrying out of an expedient[2] recently suggested does not prevent women with deformed pelves from becoming pregnant, and thus lessen the opportunity for either operation.

The following table is given by Harris,[3] showing the results of the improved Cæsarean operation in the preceding twelve months:—

[1] In a recent address by an eminent obstetrician in England, who declares himself "not much in favor of sentimental legislation," the following passage occurs: "Let us hope that the influence of this section, meeting in this beautiful town and surrounded by so much that is lovely in nature, will cast its great influence into the scale of conservatism and will do what in it lies to check the fearful tide of infant slaughter, which sweeps away annually in this country alone nearly 2000 innocent lives, besides some hundreds of mothers." What the beauty of Brighton or the loveliness of nature has to do with the relative mortality of mothers from embryotomy and from gastro-hysterotomy is not very clear. This question must be settled by a careful comparison of facts and deductions from sufficiently large statistics, not by such appeals as that quoted; it is a question of scientific knowledge, and not of sentiment.

[2] "It may also, I think, be a question of consideration whether, in women who are the subjects of such pelvic distortion that the birth of a living child *per vias naturales* is an impossibility, the removal of the ovaries, and with them the Fallopian tubes, as being both useless and possibly troublesome, ought not to be performed." It is questionable whether the practice proposed would not be conducive to immorality.

[3] Medical News, September 18th, 1886.

Countries.	No. of cases.	Women saved.	Women lost.	Children saved.	Children lost.	Percentage of women saved.
Germany . . .	25	21	4	24	1	84
United States . . .	5	0	5	2	3	0
Austria	4	2	2	4	0	50
Italy	2	1	1	1	?	50
France	2	2	0	2	0	100
Total . . .	38	26	12	33	4	

Percentage of women saved in all countries, 68$\frac{8}{19}$.
Percentage of women saved in Europe alone, 78.

In the course of the paper in which this table occurs Harris states that Léopold operated for the tenth time in June, 1886, the patient having pelvic contraction, and saved both mother and child. This gives him a loss of one woman in ten, or, from his hospital, a saving of ten women and eleven children from eleven operations. Now if such success could be obtained by practitioners generally, craniotomy upon the living fœtus would soon become unknown.

Potocki[1] gives the following table of operations done at Dresden and Leipzig:—

10 by Leopold and his assistant Korn, and
6 by Sänger and his assistants Obermann and Donat, give
15 recoveries for mothers . . . . . 93.7 per cent.
16 children living . . . . . 100 "

Method of Operating.—Garrigues[2] has recently stated that the Cæsarean operation as now performed ought not to be distinguished by the name of any particular individual as being his method, but that it is the joint product of several. The name, however, usually assigned to the improved operation is that of Säxinger. One of the most important prerequisites to success is in the operation being timely. This point has been especially insisted upon by Harris as the result of the patient collection and thorough study of extensive statistics, and his teaching has thus largely contributed to the success of the operation. Instead of realizing the importance of Cæsarean section after a woman has been several hours, or even days in labor, the operation ought, where possible, to be determined upon before the labor begins.

The next important element of success is that all care must be taken to have the patient protected from septic infection during and after the operation.

The following account of it is derived chiefly from that of Potocki:—[3]

The operation should be done early in the labor, and without frequent vaginal examinations having been made. The abdominal wall must be washed with an antiseptic solution, and some operators remove the hair from the mons veneris. The bowels and the bladder

[1] Annales de Gynécologie, June, 1886.
[2] American Journal of Obstetrics, Oct. 1886.
[3] Op. cit.

are emptied, and the patient anæsthetized. An incision is made in the linea alba 16 centimetres, 6.3 inches, long, corresponding with the middle third of the uterus, hæmostatic forceps being used to arrest hemorrhage before the peritoneal cavity is opened, this opening then being made as in ovariotomy. Next three provisional sutures are introduced at the upper part of the incision which are used to prevent the protrusion of the intestines when the uterus is brought out. The membranes are now ruptured, and the amniotic liquor discharged through the vagina. The uterus, if deviated to either side, is brought to the median line, and an incision in the middle third of the median line of the anterior wall made; in case the fœtus is dead and putrefied the uterus should be brought out before the incision is made. The fœtus is extracted, and the uterus, if this has not been done before, is brought out of the abdomen, a sponge or napkin placed behind it, and traction made upon the abdominal sutures to prevent intestinal hernia; should hemorrhage occur, manual compression of the lower segment of the uterus and of the neck should be made; a rubber tube is applied so as to constrict the neck, and prevent further bleeding. Either wait the spontaneous detachment and expulsion of the placenta and membranes, or remove them. The permeability of the internal os should be secured, and iodoform powder applied to the uterine cavity and the neck; if necessary, wash out the uterus with a corrosive sublimate or carbolic acid solution; irrigation through the uterus of the neck and of the vagina is next done.

The accurate apposition of the divided serous covering of the uterus being so essential for success, Sänger introduced the following method to secure it: Dissection of the peritoneum on each side of the incision for a distance of 3 to 5 millimetres, and then resection of the muscular tissue thus exposed to the extent of 2 millimetres. This method has, however, been abandoned, and therefore the introduction of the sutures is made at once without this preliminary step. The sutures are deep and superficial, the first being of silver wire, and the second of silk. The silver sutures, 8 to 10 in number, are introduced one centimetre from the margin of the wound, and penetrate to, but not through the mucous membrane; after these have been introduced and secured by twisting the two ends of each, the silk sutures, 20 to 25, are employed superficially to unite the serous tissue. The constricting rubber tube is now removed, the toilette of the uterus made, the uterine wound sprinkled with idoform, and the uterus returned to the abdominal cavity.

The abdominal wound is united by superficial and deep silver wire sutures. Adhesive plasters are applied from the one to the other side, but do not encircle the abdomen, for thus applied they permit abdominal distension; the wound is sprinkled with iodoform, and then iodoform gauze, salicylated cotton, and the abdominal bandage are applied; a bladder of ice is placed upon the abdomen immediately after the operation.

The after-treatment is as simple and as little active as possible. No vaginal injections are given while the pulse and temperature are normal, and there is no lochial retention.

Garrigues states that Leopold, in his first operation (1882), in order

to protect the peritoneal cavity from the entrance of blood or other contamination during the manipulations of the uterus, had a piece of disinfected gutta-percha tissue pushed behind it after it was turned out of the abdomen; this practice is now pursued by other operators also.

In looking over the histories of several of the successful operations one cannot but be struck with the fact that the measurements of the pelves were such that embryotomy would most probably have had a favorable result as far as the life of the mother was concerned—indeed, one of these women had undergone this operation three times before the pregnancy which was given so much more fortunate a termination by the improved Cæsarean section; and thus we see that this, even in its beginning, has lessened the number of craniotomies. We may justly hope that its extension will rapidly occur, and that it will still meet with corresponding success, although Dr. Barnes[1] suggests that while the Cæsarean and Porro operation will give brilliant results in the hands of men skilled in abdominal surgery, yet there would be risk of a vastly increased mortality if the general practitioner, with only a few and distant opportunities for operating, were to substitute abdominal section, as a rule, for the safer operation of craniotomy.

The Porro-Cæsarean[2] *Operation.*—The terrible mortality which, until very recently, attended the old Cæsarean section, especially in Europe, was a constant stimulus to devise modifications of the procedure so as to lessen its extreme dangers.

Cavallini, of Florence, Italy, in 1768, published a report of his experiments upon dogs and sheep, to determine the dangers resulting from the removal of the uterus; in these experiments he successfully removed from a bitch the pregnant uterus. Michaelis, of Marbourg, in 1809, suggested that the Cæsarean section would be made less dangerous if the entire uterus was extirpated. Blundell, of London, in 1828, wrote that "the dangers of the Cæsarean operation might be considerably diminished by the total removal of the uterus."

Jéser, in 1862, and Fogliata, of Pisa, in 1874, removed experimentally the pregnant uterus from a number of bitches.

In 1874, Prof. Porro, formerly of Pavia, now of Milan, performed similar operations on pregnant rabbits with recovery in every instance. It was not, however, until May 21, 1876, that he performed for the first time his operation on the human being.

Prior to this the operation suggested was the removal of the entire uterus, but Porro advocated and practised amputation of the uterus at its neck, with removal of the tubes and ovaries.

It is true that seven years prior to Porro's first operation, Prof. Horatio R. Storer, then of Boston, amputated the pregnant uterus at the cervix, but he was driven to this by the condition of the patient; for having incised a uterus that had undergone fibro-cystic degeneration, he found the hemorrhage so excessive that he was forced to amputate the uterus at the cervix in order to avoid the immediate death

[1] Proceedings of British Medical Association, Fifty-fourth Annual Meeting.

[2] I am indebted to Dr. William H. Parish, of Philadelphia, for this description of the Porro operation.

from loss of blood. He did not suggest the operation as a substitute for the old Cæsarean section.

The Porro operation, or its modification by Müller, may be performed toward the close of pregnancy and prior to the onset of labor, inasmuch as uterine contractions are not necessary to its success. The advantage of operating prior to labor consists in having choice of daylight and of ample assistance. It may be performed at any stage of labor; but, like the Cæsarean operation proper, a successful result will depend very greatly upon the labor having been of short duration and upon no attempt having been made at other methods of delivery. One should not wait until, by reason of delay, the liquor amnii has escaped and the uterine walls have been seriously contused; or until the fœtus is dead and probably putrid; or until the patient has become exhausted and suffers with septic infection. Attempts to deliver should not have been made with forceps, by version, or by craniotomy. One should promptly recognize the indication when it exists, and should not by delay or by injudicious interference render it almost impossible that the patient should recover. Whenever practicable her physical condition should be improved previously by tonics, by a liberal diet, and by proper attention to the performance of the different functions; especially should the action of the kidneys be rendered as nearly normal as possible.

For the operation the patient should be etherized and placed upon the back, with shoulders moderately elevated and thighs slightly flexed. This position renders respiration less difficult, and does not tend to force the intestines through the abdominal incision, as does a perfectly supine position. The bladder should now be emptied with the catheter, and the abdominal surface should be washed with a solution of corrosive sublimate, 1 to 1000. An incision should be made in the median line, extending from just below the umbilicus to about one inch above the pubes. After exposing the uterus compression of the cervix should be effected, either manually or with rubber tubing. A longitudinal incision should now be made in the anterior surface of the uterus. If the placenta is placed underneath the line of incision it should not be cut through, but should be detached entire. The prompt extraction of the child is necessary to its resuscitation. Care must be exercised to prevent blood or liquor amnii entering the abdominal cavity. This can be effected by turning the patient on the side and by the adjustment of cloths, rendered antiseptic, about the uterine incision. After the removal of the child the uterus, thus lessened in volume, should be lifted out of the abdomen, and an assistant must be on the alert to prevent the intestines from escaping through the abdominal incision. A wire clamp—such as the one devised by Mr. Tait—should now be tightly secured about the cervix, including the broad ligaments, so as to prevent with certainty any bleeding. The rubber tubing, if used, being now removed the uterus should be cut off, with tubes and ovaries, at about the junction of the neck and body and about a half inch above the wire. In the absence of a proper clamp, long, strong transfixion pins may be used and the cervix be very tightly tied with strong silk cord. Too much care cannot be taken in the ap-

plication of the wire clamp or the ligature about the cervix, for the cervix soon shrinks after the operation and hemorrhage may occur. The clamp is better than the ligature, as the wire can be tightened from day to day as the cervix shrinks, and the danger of hemorrhage subsequent to the operation can be thus avoided. The stump should be cauterized, sprinkled over with iodoform, and kept external to the abdomen at the lower angle of the wound, the clamp and the transfixion pins resting against the abdominal walls on either side of the incision. The toilet of the peritoneum should be as thorough as the extent of its soiling would seem to indicate. The abdominal incision should be accurately closed, especially around the stump, by means of sutures. The incision and uterine stump should be dressed antiseptically; in fact, every antiseptic precaution should be observed throughout the operation, excepting that the spray should not be thrown over the patient. The dressings should be inspected at short intervals, though not removed, for the first few days after the operation, that the earliest tendency to bleed may be discovered at once. If transfixion pins with ligatures have been used, it would be a wise precaution to ligate separately also the uterine vessels found at the sides of the stump.

In 1878 Prof. Müller modified in an important manner the operation as done by Prof. Porro. His modification consisted in making a long abdominal incision, extending from just above the pelvis to one or two inches above the umbilicus, and raising the uterine mass out of the abdomen before cutting into it. After it has been thus elevated he applied a constricting wire about the neck, controlled the circulation, incised quickly the uterus, and removed the child. The advantage of this modification consists in the important fact that fluids can be prevented with greater certainty from escaping into the peritoneal cavity. The disadvantages are the longer abdominal incision required, and the difficulty or impossibility, in several instances met with, of elevating the uterus—containing, possibly, a large child—out of the abdominal cavity. However, only a few operators have experienced this difficulty. In a Porro-Müller operation performed by myself in June, 1883, I very easily raised the uterus, with contained child and liquor amnii, out of the abdomen through an incision seven inches long and extending two inches above the umbilicus.

In the Müller modification, and in the Porro operation where the cervix has been constricted, the child is in imminent danger from asphyxia, and its quick removal is called for. It is always asphyxiated when delivered, and an assistant must be ready to institute immediate means for its resuscitation. Alternately plunging the child into hot and into cold water is one of the most effective to bring about respiration.

Prof. Veit, of Bonn, Germany, in 1880 modified the operation of Porro by dropping the stump, after ligating it, into the peritoneal cavity and closing the abdominal incision, as is now done by some operators, with the stump of a hysterectomy in the non-pregnant condition. The mortality attending Veit's method of treating the stump has been such that its further repetition should not occur. The causes

of death following it have been hemorrhage and septicæmia; and the various manœuvres instituted with the view of avoiding these dangers have not been successful.

Dr. Clement Godson and Dr. R. P. Harris have collected statistics of the Porro operation and its modification. Up to March, 1885, fifty per cent. of the mothers recovered after the Müller modification and forty-four per cent. after the unmodified Porro.

In cases of malacosteon, the amputation of the pregnant uterus, with ovaries and tubes, has in several instances been followed by a cure of the malacosteon.

The indications for the performance of a Porro operation, or its modification, are in the main the same as those for the performance of the Cæsarean operation. The very recent remarkable success following the modernized Cæsarean section has been greater than that secured by the Porro. There are, however, instances in which the Porro or the Porro-Müller would seem to promise the greatest success. When through unwarranted delay, or by reason of unwarranted attempts at delivery, the uterine tissues have been seriously injured; or when the child is putrid; or when the patient is greatly exhausted with incipient or established septicæmia, the amputation of the uterus and its appendages by the Müller method would seem preferable to a Cæsarean section. Again, when there is extensive fibroid or fibrocystic degeneration of the uterine body, an amputation at the neck would be indicated. Whenever there is especial reason to fear septicæmia, the Müller modification should be preferred to Cæsarean section without amputation.

On the other hand, the Porro, or its modification, should not be done in cancer of the neck; or when the obstruction is due to fibroid tumors of the neck, the body not being involved, as was the case in a Sänger-Cæsarean section performed by myself in 1885.

The dangers associated with the Porro operation are due chiefly to exhaustion, shock, hemorrhage, peritonitis, and septicæmia; and the dangers are very greatly enhanced if the patient has been long in labor, and if attempts at delivery by other methods have been resorted to.

Gastro-Elytrotomy.—This operation was suggested by Jörg, in 1807.[1] He proposed that after incision of the abdomen, as in the ordinary Cæsarean operation, the next step should be not incision of the uterus but of the vagina, and then if the child could not be extracted through the opening the os uteri should also be incised. He was led to propose this plan from having observed that in some cases of vaginal rupture in labor the child escaped into the abdomen.

In tracing the history[2] of this operation it may be permitted to refer first

[1] Handbuch der Geburtshülfe, third edition, Leipzig, 1828.

[2] The historical facts here presented are taken chiefly from a paper which I read before the Section on Obstetrics, Diseases of Women and of Children, of the American Medical Association, June, 1878, antedating by some months a paper by Dr. Garrigues—"Remarks on Gastro-Elytrotomy"—presented to the American Gynecological Society. My paper will be found in the twenty-ninth volume of the Transactions of the American Medical Association. This explanation is given lest it might seem that I was availing myself of Dr. Garrigues's researches, and without acknowledgment.

for a moment to two other suggestions made also in the first quarter of the present century, each of which it was thought might be less dangerous than the ordinary Cæsarean section. Sir Charles Bell,[1] in 1813, suggested that in this operation a small incision should be made in the uterus, such as would permit the introduction of the finger, dilating which a second finger could be introduced, then a third, and finally the entire hand passed in a conical shape. This incision should be as far down on the lower part of the uterus as the bladder and the peritoneal reflection will permit, for the lower part of the uterus is least vascular and most inclined to dilate.

The following is a suggestion made by Dr. Physick, in 1824:[2] Dr. Physick, said Dr. Horner in a note to Dr. Dewees, proposes that the Cæsarean in a horizontal section be made of the parietes of the abdomen, just above the pubes; that the peritoneum be stripped from the upper fundus of the bladder by dissecting through the connecting cellular substance, which will bring the operation to that portion of the cervix uteri where the peritoneum goes to the bladder. This incision being continued through this portion of the uterus will open its cavity with sufficient freedom for the extraction of the fœtus—all of which the doctor supposes may be done by a careful operation without cutting into the peritoneum.

Ritgen[3] was led by the suggestion of Jörg to advocate, in 1820, the *Bauchscheidenschnitt* instead of the *Kaiserschnitt;* and in 1821 he attempted delivery in this way, although not reporting the case until 1825.[4] The report was preceded by specific and detailed directions as to the method of operating and a statement as to the time—just when the os is fully dilated and before the membranes are ruptured. The abdominal incision was to be crescent-shaped and begin near the iliac crest and end near the pubic symphysis; arteries were to be ligated, the peritoneum to be detached with the finger, with the handle, or, if necessary, with the blade of the scalpel; the vaginal vault was to be lifted up opposite the external incision, then cut into, the incision being enlarged by the probe-pointed bistoury. After all these steps were taken the delivery was to be left to nature's forces, the obstetrician drawing the fundus and the body of the uterus toward the opposite side, so that its mouth would be more in relation with the opening in the vagina and abdomen.

In the case operated upon by him the proposed new method of delivery had to be abandoned for the Cæsarean section because of the hemorrhage from the wound and the weakness of uterine contractions; a living child was removed from the uterus, but the woman died in two days. Ritgen expressed the opinion that the transverse abdominal incision would not furnish sufficient space, and therefore a vertical one, dividing the fibres of the oblique muscle, should be conjoined.

In August, 1823, Auguste Baudelocque presented to the Faculty of Medicine of Paris a thesis entitled *Nouveau Procédé pour pratiquêr l' Opération Césarienne.* To the method proposed, essentially that of Ritgen, he gave the name *gastro-elytrotomie.* Twenty years later he attempted the operation, and in his monograph, published in 1844, entitled *Opération Césarienne, Elytrotomie, ou section du Vagine,* etc., and having now the name of Louis Auguste Baudelocque, he makes the following statement: "In the first operation of the kind I attempted, a fatal hemorrhage ensued. Subsequently I conceived the idea of tying the internal iliac,

[1] London Medico-Chirurgical Transactions, vol. iv.
[2] Dewees's System of Midwifery, eighth edition, pp. 598, 599.
[3] Die Anzeigen der Mechanischen Hülfen bei Entbindungen, Geissen, 1820.
[4] Heidelberger Klinische Annalen. Erster Band, p. 226.

and did this in my second operation. I have added to these reports a case of lateral rupture of the vagina, solely for the purpose of proving that such injury or incision of the vagina here is necessarily followed by fatal hemorrhage. On the other hand, I have brought forward an instance of posterior rupture of the vagina without hemorrhage, and have deduced from its study the last two methods of operating I advise." He called the first of the methods lateral, or subperitoneal, and the two others posterior and peritoneal. In the first patient upon whom Baudelocque attempted gastro-elytrotomy, as in Ritgen's case, the Cæsarean section became necessary; the child was dead, and the mother perished a few hours after delivery. In the second case, where he succeeded, the child was dead, and the mother died in seventy-four hours.

The next gastro-elytrotomy was done in Italy by Gianflome,[1] in 1857. The result was successful, as far as the child was concerned, but fatal to the mother.

All obstetric writers did not neglect to refer to gastro-elytrotomy, however much neglect there may have been until after Thomas revived the operation, in consulting works upon obstetrics. Cazeaux referred to it, Jacquemier entered quite fully into its consideration, and Bedford (the fourth edition of his Principles and Practice of Obstetrics was published in New York, in 1868), after referring to the proposals of Jörg and Ritgen, and the operation of Baudelocque, remarked, "Plausible as this operation may appear—to me it is the reverse—it failed completely in the hands of Baudelocque, and I am not aware that it has ever succeeded." Evidently Bedford had not considered Baudelocque's second operation, but only his first.

In 1870 gastro-elytrotomy was done by Thomas; the mother and child died within an hour after the operation, but the latter was feeble and premature, while the former was in a dying condition when operated upon, so that the fatal results were not surprising. Skene operated in 1874, removing a dead child, and the mother died in seven hours; he subsequently has had three successful operations, saving both mother and child, and Thomas also had a successful case in 1877. Harris states that laparo-elytrotomy, after the improved method of Professor Thomas, has been performed 12 times, 10 of the operations having been done in the United States, and 9 of these in Brooklyn and New York. Thomas has operated on 2 women, Skene on 4, Jewett on 2; Hime, of Sheffield (England), Edis, of London, Gilette, of New York, and Dandridge and Taylor, of Cincinnati, each on one. The results have been six mothers saved and seven children. If we, however, add to this list the case of Baudelocque and that of Gianflome, we have 14, 8 mothers dying and 8 children saved.[2] Even if the general success of the operation could be made equal to that which Skene has had, saving three mothers and three children in four operations, this by no means equals that which may be hoped for from the improved Cæsarean operation. Moreover gastro-elytrotomy is impossible in many cases, in which the other method of delivery

[1] This operation, reported under the title of Gastro-elytrotomia in Il Morgagni, Naples, 1857, p. 58, is unfortunately deficient in some important details.

[2] International Encyclopædia of Surgery, vol. vi. Harris.

can be employed. Its performance is liable to cause injury of the bladder, and it is followed by prolonged suppuration.

Operation.—Of course all antiseptic precautions are taken. The operator is upon the right side of the patient, and makes a somewhat curved incision upon the right side of her abdomen, about an inch above Poupart's ligament, extending from "a point one and three-quarter inch above and to the outside of the spine of the os pubis to a point one and three-quarter inch above the anterior-superior spinous process of the ilium, the wound being from four and a half to five inches long.[1] The muscles being gradually cut through to the peritoneum, all arteries that spurt are secured by hæmostatic pincettes, the chief vessel encountered being the superficial epigastric artery. When the peritoneum is reached, it is to be carefully separated from the tissues overlying it to the full length of the wound, and is then to be peeled from the fascia transversalis and fascia iliaca, and lifted up until the vagina is brought into view near its connection with the cervix uteri." The operator now makes a small incision from the wound into the vagina, the part to be incised being held up by the fingers, or by "a round-ended wooden instrument, introduced into the corresponding vaginal cul-de-sac." The opening thus made is enlarged by tearing with the index fingers introduced into it. The fundus of the uterus is to be drawn to the left side while the os is brought to the right, and "the fœtus is then delivered by the force of the uterus, by turning, by the forceps, or, if dead, by other instruments, and the placenta is expelled by expression, and removed through the wound."

Hemorrhage is to be arrested by ligature, or by compression. The wound is thoroughly disinfected, and the abdominal portion united by sutures. Vaginal antiseptic injections should be employed two or three times a day.

While the operation is usually done upon the right, Hime and Dandridge and Taylor operated upon the left side.

Symphyseotomy.—This operation was first proposed by Sigault, in 1768, as a substitute for the Cæsarean operation, and received his name. The Sigaultian operation "after having occupied the obstetric world for nearly half a century, fell into oblivion until its recent revival by Morisani of Naples." Harris[2] states that under Morisani and Novi, of Naples, 43 women and 42 children were saved by 53 symphyseotomies from 1866 to 1881. The instrument advised for dividing the pubic joint is small, sickle-shaped, probe-pointed, and is known as the *falcetta* of Galbiati. The following is Morisani's description of the operation: "We first make an incision of almost 3 to 5 centimetres above the pubic symphysis, and by degrees reach the articulation. We glide the falcetta upon the posterior surface of the symphysis, and having reached its lower boundary, the cutting concavity is turned against the inter-pubic cartilage, and we cut it from below above. We wait the spontaneous expulsion of the child if the contractions of

[1] Harris, op. cit.

[2] The subject is very fully presented by Harris, "Revival of Symphyseotomy in Italy," in the American Journal of the Medical Sciences, January, 1883.

the uterus are sufficiently strong; but if they are weak, and the head does not descend into the pelvic cavity, we do not hesitate to deliver with the forceps. Finally, we apply a dressing to promote immediate reunion, endeavoring to immobilize the pelvis by a suitable bandage." The advocates of the operation do not employ it if the antero-posterior diameter of the inlet is less than 67 millimetres, or $2\frac{5}{8}$ inches.

Post-mortem Delivery.—The application of the Cæsarean operation was originally made in case of women advanced in pregnancy dying undelivered. This was the civil law in Rome dating from the time of Numa Pompilius. But the fact that post-mortem delivery by an abdomino-uterine incision was recognized in ancient mythology—as is exhibited by the history of the birth of Bacchus, the god of wine, and that of Æsculapius, the god of medicine—renders it probable that the operation is still older.

The Church, as Hubert remarks, merely reproduced the injunction of the Roman law in the following decree of its Ritual: Si mater prægnans mortua sit, fructus quam primum caute extrahatur.

Three questions arise in reference to post-mortem delivery, the first relating to the period in pregnancy when death occurs that this should be done; the second as to the method, and the third as to how long after the mother's death can the operation be done and a living fœtus extracted. In regard to the first, Duer,[1] in his elaborate paper, gives the rule that the fœtus should be artificially removed in all "otherwise favorable cases which have attained to the neighborhood of the sixth month of pregnancy."

As has already been indicated, the method of delivery exclusively recognized in ancient times, and indeed that which is most generally followed since, was the Cæsarean section. Unfortunately, in some instances, where this method has been resorted to the woman was not dead, and more than one operator has fled horror-stricken upon finding the manifestations of life when he thought his incisions were made upon a corpse. Thévenot[2] has earnestly contended for delivery through the natural passage as successfully done by the Italian school, especially by Rizzoli, and asserts that the post-mortem Cæsarean operation belongs to another age and ought to disappear from our practice. Depaul, in 1861, said, "I cannot too strongly insist with almost all those who have studied this subject, upon the advantages which extraction of the infant by the natural passage gives. One ought not to hesitate in the application of a bistoury to the cervix and relieving resistance by multiple incisions. There can be thus obtained in a few seconds sufficient dilatation to perform version or to apply the forceps." There have been several successful deliveries effected in this way, but of course it is only applicable in normal conditions of the pelvis, and will be most successful when death of the mother occurs during labor. The method is especially applicable in cases of apparent death, or when there is doubt in regard to the question as to whether life is actually extinct.

[1] American Journal of Obstetrics, volume xii.

[2] De l'Accouchement artificiel par les voies naturelles substitué a l'opération Césarienne post-mortem. Paris, 1878.

If the Cæsarean operation is employed, the same precautions should be used as if it were being done upon the living subject. In Duer's table, including 55 cases, "the time that elapsed between the death of the mother and the removal of a living child was in 40 as follows: Between 1 and 5 minutes, including 'immediately,' and 'in a few minutes,' there were 21 cases; between 5 and 10 minutes, none; between 10 and 15 minutes, 13 cases; between 15 and 23 minutes, 2 cases; after 1 hour, 2 cases, and after 2 hours, 2 cases. In addition to the two cases of survival for two hours after the death of the mother, which Duer has given, Hubert mentions one where the mother was instantly killed by being struck by a railway locomotive, both her legs being cut off and her head fractured, and yet two hours after the accident a living child was removed by the Cæsarean operation. Nevertheless such prolonged continuance of life is altogether exceptional, and indeed in the great majority of cases where the delivery is post-mortem, no matter how prompt that delivery, or what the method, the child will be dead.

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